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445,888

ALIEN PROPERTY CUSTODIAN

AUTOMOBILE ROOF

Karl Tandetzke, Berlin, Germany; vested in the Alien Property Custodian

Application filed February 5, 1941

This invention relates to roofs of vehicle bodies and refers more particularly to an automobile roof pressed out of laminated materials saturated in synthetic resin.

Automobile bodies consisting of laminated materials saturated in synthetic resin, may be made of individual parts, each of which is shaped separately into the desired form by the application of heat and pressure. These parts are then easily united into a complete vehicle body which has great resistance against pressure and shocks and does not require any supporting ribs. Additional advantages of this construction are the simplification of the assembling operation, cheapness of manufacture and the possibility of replacing any damaged part of the body without having to replace the body as a whole.

The roof of such vehicle bodies is a part which is subjected least of all to any external stresses. In self supporting automobile bodies the roof serves largely as a support constituting the connecting and reinforcing element of the body.

An object of the present invention is the provision of a vehicle body, the roof of which constitutes an exceptionally strong and secure force-transmitting connection between the front and the rear of the body.

Other objects of the present invention will become apparent in the course of the following specification.

In accomplishing the objects of the present invention it was found advisable to form the roof of a vehicle by pressure as a single piece, without joints, said piece having the form of a continuous trough extending from the windshield to the rear of the car.

In accordance with a preferred embodiment of the inventive idea, the posts situated close to the windshield and, possibly, a part of the rear portion of the body extending approximately to the baggage compartment, are pressed along with the roof, and constitute a single pressing extending as a bridge between the front and the rear of the vehicle. The connections or the supports of this piece are situated then at the level of or below the lower edge of the windows.

An advantage of this arrangement is that the roof can be mounted upon the remaining part of the body without any special frame and that no special adaptation of its form to the edges of the sides of the body is necessary. The roof is merely connected at its sides with the middle posts upon which the doors are suspended. It is not necessary to have a special window frame which in prior art constructions was made of one piece with the side of the body. In accordance with the present invention, the sides of the body extend only to the lower edges of the windows and a window is inserted into an opening formed between an edge of the roof, a middle post and the lower edge of a side of the vehicle body.

The invention will appear more clearly from the following detailed description when taken in connection with the accompanying drawings showing, by way of example, preferred embodiments of the inventive idea.

In the drawings:

Figure 1 is a side view of a vehicle body having a continuous roof and consisting of pressed out parts saturated in artificial resin.

Figure 2 illustrates a section bar pressed into the roof and is a transverse section along the line 2—2 of Figure 1.

Figure 3 is similar to Figure 1 and illustrates a somewhat different construction.

Figure 4 illustrates a section bar inserted into the roof, and is a transverse section along the line 4—4 of Figure 3.

The automobile body shown in Figures 1 and 2 has a front portion **1** which serves as a support for the hood, a roof **2**, sides **3**, door posts **4** and a rear portion **5**, enclosing the opening of the luggage compartment and consisting of an upper part and a lower part. All these elements are connected to each other by pressed out transversely extending flanged edges, in a manner well known in the art and not illustrated in the drawings.

The parts of the automobile body consist, preferably, of bands of paper, textiles or other fibrous material saturated in a binder consisting of or similar to an artificial resin, to form laminated layers impregnated with artificial resin.

Thus, the body parts are formed of continually extending bands, whereby the forming and pressing operations are considerably facilitated. The parts are comparatively thin and have no portions of greatly increased thickness, so that the time necessary for the pressing and hardening is diminished to a desirable minimum.

In accordance with the present invention, the roof **2** of the automobile body is pressed out of one piece with the frame **6** of the windshield. The roof **2** has the form of a continuous one-piece tray and constitutes a bridge-like support connecting the front part of the automobile body with the rear. Due to this form, the roof is exceptionally strong and has great resistance against shocks and external forces. The roof is

of substantially uniform thickness throughout its length and edges.

The line 7 in Figure 1 indicates the connection between the front edge of the roof 2 and the front portion 1, while the line 8 indicates the connection between the rear edge of the roof 2 and the rear portion 5 of the automobile body.

The middle posts 4 consist of section bars coated with artificial resin, the upper ends of which are firmly connected to the roof edges by any suitable means not shown in the drawing.

The rear side portions 3 of the automobile body are connected to the middle posts 4, to the edges of the roof 2 and to the rear portion 5. Thus an opening *a* is formed on each side of the body between the parts 2, 3 and 4, into which the side window frame 9 is inserted.

The free edges of the roof 2 may be provided with section bars serving the double purpose of increasing the rigidity of the roof and of strengthening its edges. These section bars extend longitudinally along the edges of the roof 2 and constitute a self-supporting frame.

Figure 2 shows a hollow section bar 10 which may consist of a hard aluminum alloy and which is pressed into an edge of the roof. The bar 10 has a triangular cross section and one of its two sides is somewhat curved to conform to the curvature of the roof.

As shown in Figure 2, the bar 10 is firmly embedded between an edge 2*a* of the roof and an inner vertical flange 11.

The lower side of the bar 10 is closed by a transverse ledge 12, which strengthens it and constitutes its bottom. The ledge 12 is provided with an outer step-like downwardly extending projection 13, to form a support for the elastic frame 9 of the side window. Another support holding the window frame 9 is formed by inner ledge 14 constituting a covering for the bar 10 and having a flange 18 which presses against the window frame 9. Thus the upper window frame portion 9 is clamped between the flanges 13 and 18.

The ledge 14 is attached to the bar 10 by bolts 15, and, in addition, serves as a support for the roof covering *c*. The covering *c* has a reinforced edge 16 which is clamped by the upper end of the ledge 14, so that the edge 16 is firmly held between the flange 11 on one hand and the ledge 14 on the other hand.

Transverse sticks 19 are used to stretch the roof covering *c* and to hold it in position below the roof 2.

As shown in Figure 1, the metal bars 10 project beyond the roof 2 in the form of supporting columns 24 extending along the automobile portion 1, which are used for attaching the roof 2 to the front element 1 of the automobile body.

Only one of the flanges of each of the two bars 10 is extended beyond the rear edge of the roof 2. These flanges form columns 25 serving as connections between the sides 3 and the rear portion 5 of the automobile.

The automobile body shown in Figure 3 is substantially similar to that shown in Figure 1, the same parts being designated by the same numerals.

In this construction, the front portion 1 is combined with the windshield frame 6 to one piece, so that the joint between the roof 2 and the front portion extends along the line 17.

The roof 2 extends down to the rear portion 5 and the line 18 will constitute the connection between these two parts.

Figure 4 illustrates a steel bar 20 which is attached to the edge of the roof 2 after the latter has been completed. The steel bar 20 has the form of a hollow body, such as a box in cross section and consists of U-shaped section bars which fit one into the other.

The bar 20 is attached to the roof 2 by tubular rivets 21 which are covered from the outside by a bent ledge-like edge 22 of the support 20.

In the course of the assembly, the rivets 21 are inserted from the outside into corresponding bore holes provided in the edge of the roof 2 and are affixed therein by any suitable correspondingly shaped tool, such as pliers (not shown).

The bent edge 22 of the steel bar 20 makes it possible to dispense with any separate constructional element for the covering of the rivet heads and at the same time, strengthens and protects the edge of the roof 2; it serves as a counter-support and a covering for the rivets 21.

The steel bar 20 is attached to the window frame 9, the covering ledge 14 and the roof covering *c* in a manner similar to that shown in Figure 2.

It is apparent that the specific illustrations shown above have been given by way of illustration and not by way of limitation and that the structures above described are subject to wide variation and modification without departing from the scope or intent of the invention. For instance, any constructional details of the body shown in Figure 1 may be incorporated in the body shown in Figure 3. All of such and other variations and modifications are to be included within the scope of the present invention.

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Fig. 1.

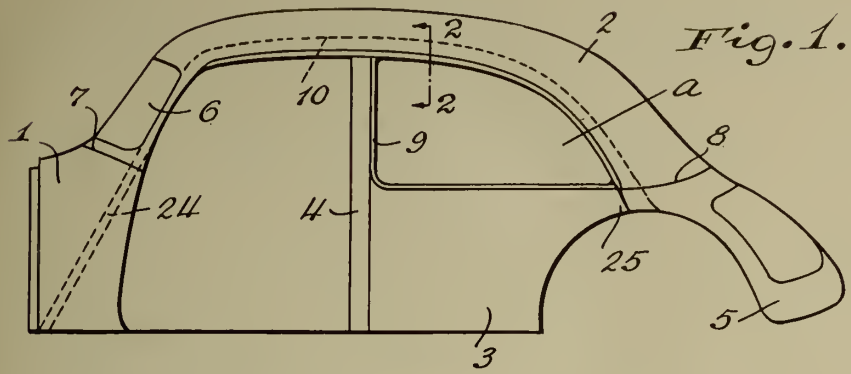


Fig. 2.

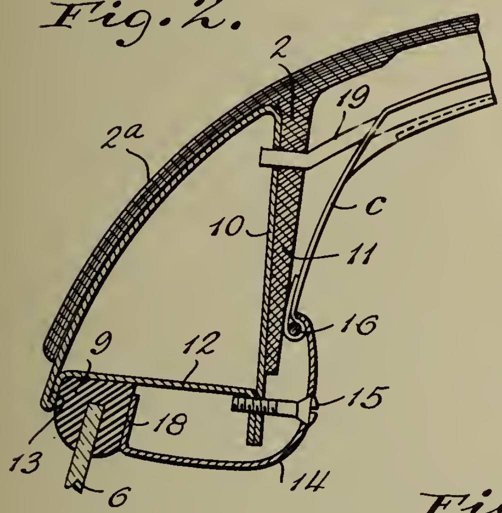


Fig. 4.

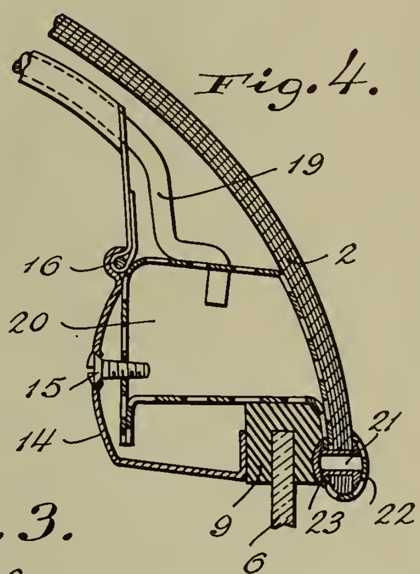
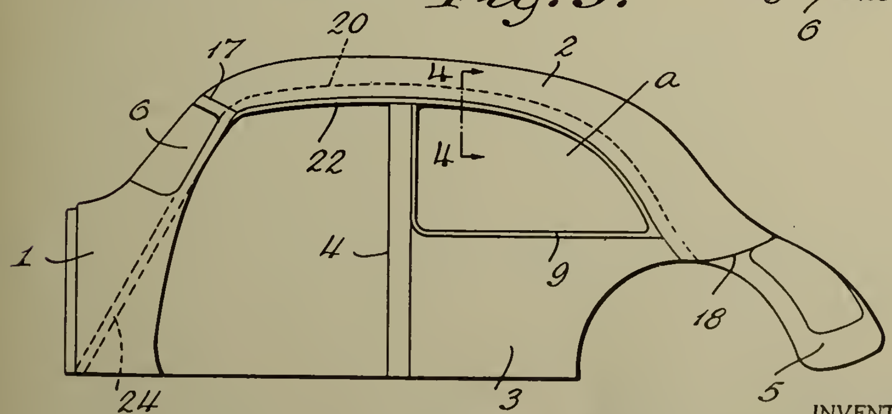


Fig. 3.



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ALIEN PROPERTY CUSTODIAN

DIAPHRAGMS FOR ELECTRON OPTICAL APPARATUS

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Application filed February 6, 1941

This invention relates to diaphragms to be inserted in the path of ray of electron optical apparatus.

Such diaphragms, particularly diaphragms employed in electronic microscopes, often require a very small diameter in the case of a considerable diaphragm thickness (mass thickness). As is well known it has hitherto been possible to provide by the mechanical method the diaphragm with a bore of a diameter amounting only to 50 μ. The object of the invention consists in manufacturing diaphragms having effective openings of smaller dimensions. This may be accomplished according to the invention by employing the point of crossing of two slits as a diaphragm. In this manner it is possible to provide the diaphragm with channels, the dimensions of which amount only to a few μ in the case of a considerable diaphragm thickness. The diaphragm itself consists of two slits which are in turn made, for instance, of sheets of tantalum of 0.1 mm. having a ground and polished edge. The grinding is preferably effected in a plane perpendicular to the plane of the sheet of metal, and the ground surface must be polished in order to attain an accurate diaphragm channel even in the case of the smallest diaphragm dimensions to be adjusted. The diaphragm aperture is preferably formed by so crossing two narrow slits as to be perpendicular to each other. The slit width is preferably adjusted by the use of a dissecting microscope and the sheets forming the slits are then fastened by a clamping device.

According to the invention also a multiple cross-slit diaphragm may be made in a simple manner. To this end, the arrangement is so designed that one slit may be so adjusted as to assume the form of a wedge and that two or more slits lying perpendicularly to the wedge-shaped slit are formed of three or more sheets of metal. The wedge-shaped slit may be carried out in such a manner that the two sheets of metal forming the same abut at one end thereof and are opened at the other end, for instance, $1-2\times10^{-2}$ mm.

Such a multiple cross-slit diaphragm is shown by way of example in the accompanying drawings. In this embodiment a diaphragm arrangement is involved which may be inserted in the path of ray of an electronic microscope.

Fig. 1 shows a top view of a diaphragm arrangement and Fig. 2 a cross-sectional view thereof. 1 and 2 denote the pole shoes of the magnetic lenses of an electronic microscope (not shown). 3 is the channel for the passage of the electron ray. In this path of ray is inserted a diaphragm arrangement. This arrangement has a mechanically adjusted diaphragm aperture 4 having a width of, for instance, 50 μ and two cross-slit diaphragms 5 and 6, the width thereof amounting, for instance, to 10 μ and 3 μ respectively. The two cross-slit diaphragms are formed of the slits 7, 8 and 9. To form the slit 7, two sheets of metal 10 and 11 are employed which are adjusted as shown in a wedge-shaped manner. The slits 8 and 9 are formed of the three sheets of metal 12, 13 and 14.

The adjustment of the wedge-shaped slit 7 is effected by means of a dissecting microscope. The sheets of the wedge slit are then fastened by means of a grip member 15 with the aid of the screws 16. The slit 8 is then adjusted by the dissecting microscope with the aid of the sheets 12 and 13 and then fastened with the aid of the corresponding grip members 17, 18. Also the slit 9 may then be adjusted with the aid of the sheet 14 and is fastened by the grip members 19, 20.

By adjusting on the one hand the wedge-shaped slit 7 as described above and by selecting on the other hand the position of the slits 8 and 9 with respect to the wedge-shaped slit 7, it is possible to obtain diaphragms having the same dimensions in both main directions. The fact that the two centers of gravity of the diaphragms are displaced from each other in the two main directions by about $\frac{1}{10}$ mm. and that the diaphragm has a square cross-section has hardly any influence on the quality of the microscopical image.

Without rendering the adjustment of the diaphragm too difficult it is possible to provide the diaphragms with channels having as small a diameter as 3×10^{-3} mm. 21 denotes a slidable diaphragm reed, in whose lateral parts are secured the set screws 16, 18 and 20. The entire device may be displaced by a diaphragm reed in the main direction of the wedge-shaped slit 7 so that the diaphragm channels 4, 5 and 6 may be inserted at will in the path of ray of the electronic microscope. The single diaphragm openings 4, 5 and 6 lie on a straight line coinciding with the direction of displacement so that the passage from one diaphragm to the other is facilitated to a great extent.

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DIAPHRAGMS FOR ELECTRON OPTICAL APPARATUS

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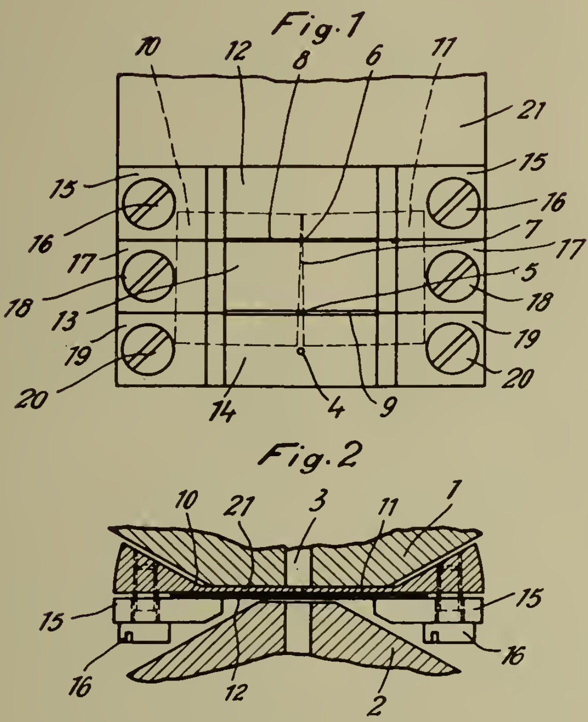

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ALIEN PROPERTY CUSTODIAN

WELDING ROD, AND IN PARTICULAR ELECTRODE FOR ELECTRIC ARC WELDING

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The present invention relates to a welding rod and in particular to an electric arc welding electrode having additions arranged between a number of metallic elements running parallel to the axis of the rod.

Welding electrodes of this kind are known which are made up of wires obtained by rolling and by drawing and twisted together, the spaces between the wires being filled with addition substances.

These rods have the disadvantage that they are expensive to manufacture because the elementary wires of which they are made have had to be manufactured by rolling and drawing and the smaller they are, the more expensive they are. Moreover, these wires contain numerous small gas pockets which, when the end of the rod is heated, explode and, consequently, cause a violent projection of the surrounding metal. Finally, the addition substances are in contact with each other. Therefore, they can deteriorate when the rods are stored.

Welding rods of the above-mentioned kind are also known which are made up by agglomerating long metal fibres of small cross section which extend approximately parallel to the axis of the rod, addition substances being arranged between the fibres.

These rods do not have the disadvantage of having a large number of gas pockets between the fibres of which they are made up, but their electrical conductivity, although quite satisfactory, is not as perfect as that of a rod made up of elements which extend without discontinuity from one end of the rod to the other. Furthermore, the addition substances which are arranged between the fibres can react on each other when the rods are stored.

One object of the invention is to provide a welding rod in which these disadvantages are not present.

To this end, in the rod in accordance with the invention, the above-mentioned additions are arranged in channels which are isolated from each other and are bounded by the faces of the folds of a thin strip.

Preferably, these channels are also isolated from the outside. The isolation can be assured by a fluid-tight sheath which may advantageously, contain substances which contribute to the production of a good deposited metal. It can also be ensured by welding to each other at the periphery the faces of the formed folds.

The use of a thin strip has the advantage of considerably reducing the thickness of the walls of any gas pockets which it may contain.

Consequently, these pockets can explode at a lower pressure and they only give rise to a mild projection of metal. The use of thin wires having a diameter near that of the thickness of the strip used in accordance with the invention would not be possible in practice because of the high manufacturing cost of such wires. Moreover, the rods formed by such wires would be too flexible to be used normally for welding operations.

In one useful embodiment, the addition substances are maintained in a dry condition by being squeezed between the faces of the formed folds of the strip.

The strip from which the welding in accordance with the invention is formed, is preferably a thin strip which has been cut out by means of tools from metal blanks of fairly great thickness relatively to the thickness of the strip to be obtained. In this case, the cutting cut causes a large number of small pockets which may exist in the blank from which the strip is made to be opened.

Another object of the invention is the method of manufacturing of a welding rod and in particular of an electrode for electric arc welding.

In the method in accordance with the invention, a strip is folded longitudinally, addition substances are introduced between the faces of the formed folds, and the addition substances are held in place by tightening these faces against each other.

In order to ensure the precisely exact quantity of addition substances where these are in the form of powder or of other small particles, the folds are gauged before the additions are introduced into them and the height of the layer of additions between the faces or the formed folds is adjusted before the substances are squeezed between these facts.

Other features and details of the invention will become apparent in the course of the description of the drawings attached to the present specification and which show diagrammatically and merely by way of example two installations for making a welding rod in accordance with the invention and the changes in cross-section of this rod which take place during the different phases of the method in accordance with the invention.

Figure 1 is an elevation of one of these installations,

Figure 2 is a plan view of the installation shown in Figure 1,

Figure 3 is a section on the line III—III in Figurges 1 and 2, drawn to a larger scale,

Figure 4 is a vertical section taken on the line IV—IV in Figures 1 and 2,

Figures 5 and 6 are diagrammatic representations of the cross-section of a welding rod at two phases of a variant of the process which is used with the installation shown in Figures 1 to 4,

Figure 7 is an elevation of a second installation for making a welding rod in accordance with the invention,

Figure 8 is a plan of the installation shown in Figure 7,

Figure 9 is a diagrammatic representation of the changes in the cross-section of a welding rod which take place at different phases of the process used with the installation of Figures 7 and 8.

The same references have been used in the various figures to denote similar elements.

The installation in Figures 1 to 4 comprises a cylindrical piece **2** which turns in the direction of the arrow X in front of a tool **3** which advances radially in the direction of the arrow Y towards the axis of the piece **2** as and when a thin strip **4** is unwound from the latter.

This thin strip is rolled hot between rolling cylinders **5** so as to restore to it the elasticity which it may have lost while being cut out. The heating of the strip before it is rolled is effected, for example, by means of a Joule effect due to the fact that the strip, after being cut out, passes between rollers **6** connected by means of contact members **7** to one of the terminals **8** of a source of current, the other terminal **9** of which is connected through contact members **10** to the rolling cylinders **5**. Between the rollers **6** and the cylinders **5**, the strip passes through a hot chest **11** the object of which is to prevent its cooling.

After its passage between the rolling cylinders **5**, the strip is folded longitudinally. To this end, it passes successively through pairs of shaping rollers designated **12**, **13**, **14**, **15**, and **16**. The shaping rollers are provided with grooves of generally triangular shape. The face of the grooves in the different pairs all have the same width, but the angle which these faces make with each other varies from one pair of rollers to the next.

As can be readily seen from an inspection of Figure 2, the triangular grooves decrease in width as the distance of the rollers to which they belong from the point at which the folding of the strip starts, increases. The depth of the grooves obviously varies inversely proportionally to their width as the two faces of the grooves of all the shaping rollers have the same width.

By means of this special method of folding the strip, folds of constant length are obtained, and transverse drawing of the metal is avoided so that there is no danger of its being torn during the folding, even when the folding is carried out cold. When the folding is carried out in this manner, it is even possible with certain strips to dispense with the rolling of the strip after it has been cut out.

After it has left the last pair of shaping rollers **16**, the folded strip passes through a die **17** (Figures 1 to 3) comprising two parts **17**a and **17**b between which the folding is gauged. When it leaves this die, the folded strip enters a casing **18**, the top **19** (Figure 1) of which is assumed in Figure 2 to be removed and the side face **20** (Figure 2) of which is assumed in Figure 1 to be removed.

The various operations which are carried out is this casing are effected out of contact with the air and moisture. To this end, dry nitrogen can, for example, be introduced through an opening **21** situated at one of the ends of this casing, this nitrogen escaping through an opening **22** situated at the opposite end.

In the casing **18**, there is a vessel **23** containing, for example, powdered ferro-chromium. The folded strip passes through this vessel. The ferro-chromium powder is introduced between the faces of the formed folds and the quantity of powder contained in each fold is regulated with precision by the height of the layer in each fold. This height is determined by the position of a comb **24** the teeth of which project between the faces formed by the folding and the level of which is adjustable. To this end, this comb is provided with a rack **25** meshing with a pinion **26** which can be turned from the outside of the casing **18** by means of a crank **27**.

In order to facilitate the descent of the addition substances into the receptacle **23**, provision is made for agitating these substances in the receptacle by subjecting the latter to vibrations created by an electromagnet **37** (Figures 1 to 4) fed from a source of alternating current **38** having an industrial frequency. The vessel **23** is also subjected to the action of a returning spring **39**.

The descent of the added substances into the vessel **23** is also facilitated by the downwardly flaring shape of the part of this vessel which lies above the folded strip.

Addition substances can also be introduced into the channels formed by the faces of the folds at the lower part of the folded strip. These substances can be pressed in any desired manner between the faces of the folds, for example by means of rollers.

In Figures 1 and 2 there is shown a roller **28** (Figure 1) which forces a nickel wire **29** coming from a spool **30** between two of the faces of the folds into the lower part of the folded strip.

After the various additions have been introduced between the faces of the folds of the strip, these faces are approached by causing the strip to pass between two rollers **31** the axis of which is at right angles to the mean plane of the folded strip. The passage of the strip between the rollers **31** has the effect of tightening the addition substances strongly between these faces.

Where powder is introduced only into the channels formed by the faces of the folds in the upper part of the folded strip, the folding can be advantageously effected in such a way that the plane passing through the free edges of the external face of the external folds does not meet any of the other faces of the folds. In this way, as is shown diagrammatically in Figure 5, folds are formed the free edges **40** and **41** of the external faces of which are above the other faces of the folds. After various additions have been introduced, these edges are brought near to each other as indicated in Figure 6 so as to prevent the powder from escaping between the folded faces. The strip treated in this manner is then passed between the rollers **31** which, as indicated above, has the effect of tightening the faces of the folds on to each other.

The mass which is obtained at exit from the rollers **31** is rolled hot between the rolling cylinders **32** the profile of which corresponds to that of the desired electrode. The axis of these cylinders is at right angles to the plane of the faces in contact. The heating of the mass which is to be rolled hot is effected, for example, electrically by the Joule effect between the rollers **31** and

the rolling cylinders **32**. The rollers **31** are connected by means of contact members **33** to one of the terminals **34** of a source of current, the other terminal **35** of which is connected by means of contact members **36** to the rolling cylinders **32**.

By having been passed hot through the rolling cylinders **32**, the external parts of the folds are welded to each other and insulate the addition substances from the outside. These addition substances are maintained properly in place although at no time have they been in the form of a paste. Their incorporation in the electrode can be effected completely dry. The electrode which is thus obtained can leave the casing **18** through the opening **21** without there being any possibility of reaction between the various addition substances or between the latter and the outside. It is therefore possible to use as additions, substances which are hygroscopic or parts which are liable to oxidation.

In the electrode obtained in this manner, the additions are excellently distributed over the whole mass. The electrode contains very little occluded gas and therefore it gives rise to fewer projections during the welding than in the case of solid electrodes. The proper distribution of the additions throughout the mass allows alloys containing a high proportion of various metals to be obtained.

Furthermore, it is easy to ensure that the precisely exact quantity of the additions will be provided by the gauging of the folds of the strip and by regulating the height of the powder between the faces of the folds.

It is even possible to make quite easily an electrode in which the quantity of the additions varies from one cross section to another. For that purpose, it is only necessary to cause the height of the comb **24** to vary during the passage of the folded strip through the vessel **23**.

An electrode of this kind is useful when, for example, a metal object having a given composition has to be covered with a layer of metal or of an alloy having a different composition. In this case, it may be advantageous to start the deposition of this layer by means of an electrode the composition of which is near that of the part to be covered and to continue the deposition by means of a metal the composition of which is more and more nearly that which one wishes to obtain at the outside of the covering layer.

It is also possible to make a welding rod in accordance with the invention by folding the strip in a different way from that indicated above. Thus, in the installation shown in Figures 7 and 8, which comprises a number of parts identical with corresponding parts of the installation of Figures 1 to 4, the strip **4**, when it leaves the rolling cylinders **5**, is folded longitudinally in such a way that its cross section, after having passed through the shape indicated at *b* in Figure 9, is made U-shaped as shown at *c*.

To this end, it passes successively between shaping rollers **42** and **52**. The upper rollers have projections **43** and **53** respectively of trapezoidal and rectangular shape, while grooves **44** and **54** which have corresponding shapes are formed in the lower rollers.

The strip then enters the casing **18**, the top **19** (Figure 7) of which has been assumed to have been removed in Figure 8, and the side face **20** (Figure 8) of which has been assumed to have been removed in Figure 7.

In the casing **18**, there is a vessel **23** containing powder and identical with that of Figures 1, 2 and 4. The powder fills the bottom of the channel formed by the U-shaped strip and the height of the powder **45** (Figure 9) is determined by the position of a lath **46** the position of which is adjustable like that of the comb **24**.

The strip then passes between the rollers **47**. The lower roller is smooth and a groove **48** of trapezoidal cross section is formed in the upper roller.

The cross section of the strip then takes up the shape shown at *e* in Figure 9, then that shown at *f* when it leaves the plain rollers **49**. then brought against the strip which is rolled to A nickel wire **29** coming from the spool **30** is then brought against the strip which is rolled to angle shape (see *g* Figure 9) by grooved rollers **50** and **51** which force the wire **29** into the apex of the angle. The two legs of the angle are then brought into contact with each other by causing the strip to pass between the rollers **31** which have a vertical axis.

The manufacture of the electrode is then finished off in the same manner as in the case of the installation of Figures 1 to 4.

To insulate from the outside, the addition substances which are between the faces of the folds, it is not necessary that these faces should be welded at the periphery. For example, the electrode obtained by tightening the addition substances dry within the folds can be covered with a fluid-tight sheath formed of varnish. Oxidation of the electrode is thus avoided. Again, when an iron strip is used, it can be annealed in such a way that it passes through the blue zone. In this way, as oxidation can no more occur, the varnish can be dispensed with. A fluid-tight sheath can also be used which contains substances which contribute to the production of a good deposited metal. Among these substances can be mentioned not only those which form part of the composition of the deposited welding metal, but also those, which in the case of an arc welding electrode, serve to direct the arc. The fluid-tight sheath in question can also contain substances which are electrical insulators and which prevent the formation of short circuits when the electrode comes into contact with the part to be welded at a point other than its extremity from which the arc is to spring.

The pulverised substance which is added to the strip need not necessarily be metallic. Moreover, instead of powder, substances in the form of fibres, chips, etc., can be added.

Other means could, of course, be used instead of an electro-magnet fed with alternating current for vibrating the vessel **23**. The additions contained in the vessel **23** could also be agitated otherwise than by vibrating the vessel. In particular, an agitator could be arranged within the mass of additions contained in the vessel **23**.

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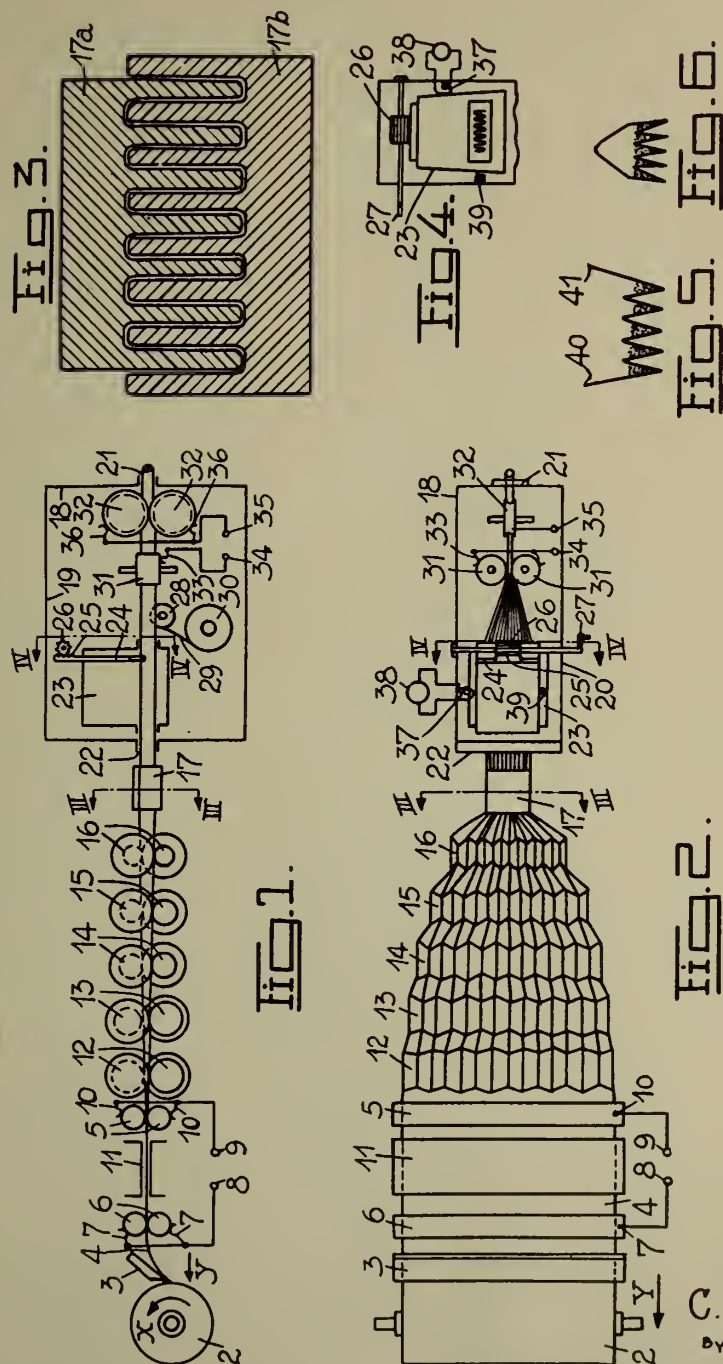
2 Sheets-Sheet 1



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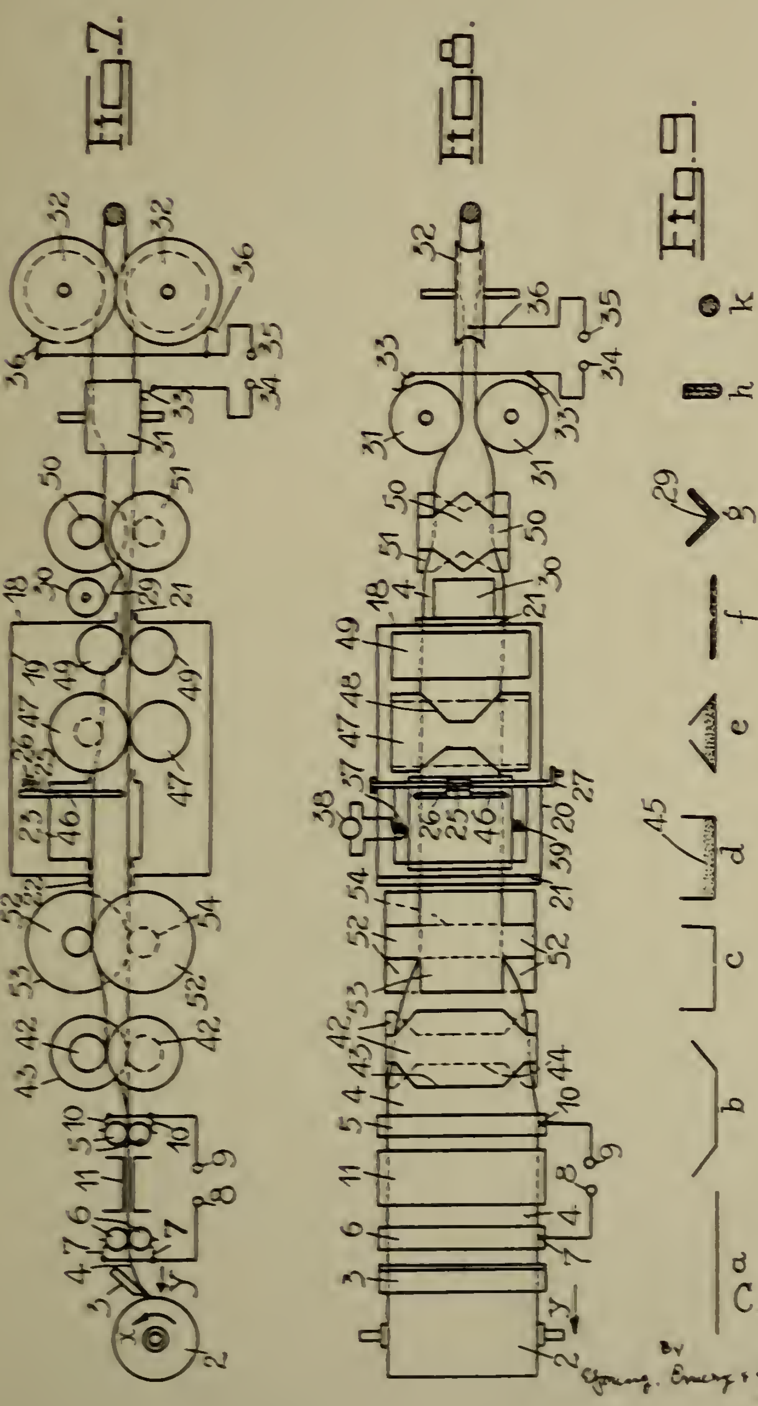
2 Sheets-Sheet 2



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ALIEN PROPERTY CUSTODIAN

BALANCING THE THRUST OF BLADED DISCS IN RADIAL FLOW ROTARY MACHINES

Ulrich Meininghaus, Muelheim-Ruhr, Germany; vested in the Alien Property Custodian

Application filed February 19, 1941

The present invention relates to rotary machines such as steam or gas turbines in which a working medium flows through a plurality of blades in a radial direction, varying in pressure during such flow.

It is the general object of the invention to provide an improved balancing of the thrusts of the discs carrying the radially traversed blades, and in particular to balance the thrusts of a plurality of such bladed discs by the thrust of one single inwardly traversed labyrinth and jet to secure an almost perfect balance at all conditions. Other, more specific objects of the invention will appear from the detailed description hereinafter.

The accompanying drawings illustrate by way of example two embodiments of the invention. Figs. 1 and 2 of the accompanying drawings are vertical sections through radial flow steam turbines constructed according to the invention.

In Fig. 1 the steam enters the turbine at 1, impinges the nozzles 2 and the blades 3 of the velocity stage and then flows through the radially traversed reaction blades 4 to 7. The rear sides of the wheels 8 and 9 which carry the blades 3 and 7 are each fitted with a labyrinth packing 10 and 11. The labyrinth packing 10 is connected at its outer circumference with the space behind the nozzles 2, that means with the steam before it enters the first radial flow blading 4; at its inner half, it is connected with the space 13 between the bladings 6 and 7 by means of the pipe 12. The steam of this space 13 flows to the labyrinth packing 11 through the holes 14 in the wheel 9. The labyrinth packing 11 equalizes in good approximation the axial thrust of the blading 7. It would be possible to guide the leaking steam from the pipe 12 directly to the labyrinth packing 11, but with the illustrated arrangement I gain the advantage that the hot leakage steam increases the work transformed in the blading 7 and that comparatively cold steam which gave off part of its heat content in the bladings 4 to 6 enters the labyrinth packing 11. The flange 15 between the bladings 5 and 4 may serve for admitting by-pass-steam or for bleeding.

By leading the first connection of the inner part of the inwardly traversed labyrinth packing 10 with the steam flow through the blading by means of the pipe 12 to a point behind the second plane of the radially traversed blading 5, but before the outlet of the last plane of the radially traversed blading 7 I obtain for the first time a characteristic of the change in thrust for the inwardly traversed labyrinth packing 10 which coincides surprisingly well with the characteristic of change in thrust for the radial flow blading. Generally these characteristics differ in a degree that makes the convenient form of the inwardly traversed labyrinth packing unfitted for balancing the thrust of high pressure turbines. The main reason for this disadvantage lies in the fact that the diameters of the labyrinths and therewith the size of the throttling areas decrease whilst the steam expands. The best effect is reached when the first connection of the inner part of the inwardly traversed labyrinth packing 10 with the steam flow through the blading is led as shown in Fig. 1 by means of the pipe 12 to a point between the third plane 6 and the fourth plane 7 of the radially traversed blading. It is then possible to admit by-pass-steam or to bleed steam at 15 between the second and third planes 5 and 6 without disturbing the balance of the thrusts. I prefer to provide an additional labyrinth packing 11 which is traversed in an outward direction to relieve the thrust of the labyrinth packing 10 at least by the thrust of one plane of the radial flow blading. Such outwardly traversed labyrinth packing 11 may advantageously be arranged at the rear side of the last wheel 9 and balance about the axial thrust of the blading 7 of such wheel. By such arrangement I obtain a practical perfect balance at all conditions with simple parts and a great compactness. When the steam volume is large, the wheel 9 may carry on the rear side also blades traversed parallel to the blading 7 instead of the labyrinth packing 11.

In Fig. 2 for which the same reference characters apply as for Fig. 1 the inner part of the outwardly traversed labyrinth packing 11 is taken off up to a diameter which about corresponds to the mean outer diameter of the bladings 4, 5 and 6. The connection of the inner part of the inwardly traversed labyrinth packing 10 with the steam flow in the blading leads through pipe 12 to the inner diameter of the outwardly traversed labyrinth packing 11 and through the holes 14 in the wheel 9 to the corresponding point of the blading 7. With this arrangement I balance the sum of the thrusts of the bladings 4, 5, 6 and of the inner part of the blading 7 by the thrusts of the inwardly traversed labyrinth packing 10. Only the thrust of the outer rim of the blading 7 is balanced by the outwardly traversed labyrinth packing 11. As the areas of the bladings 4 to 7 as far as they are balanced by the labyrinth packing 10 are approximately equal any change

in course of the pressure drop through such blading does hardly effect the balance. The pressure at the shaft glands is further reduced and the arrangement simplified as compared with Fig. 1. But the perfectness of balance at all conditions is the best with the arrangement of Fig. 1.

Obviously, my invention is not restricted to rotary machines of the specific form illustrated, but for example may be used with machines having axially traversed blades or labyrinths which are staggered in radial direction.

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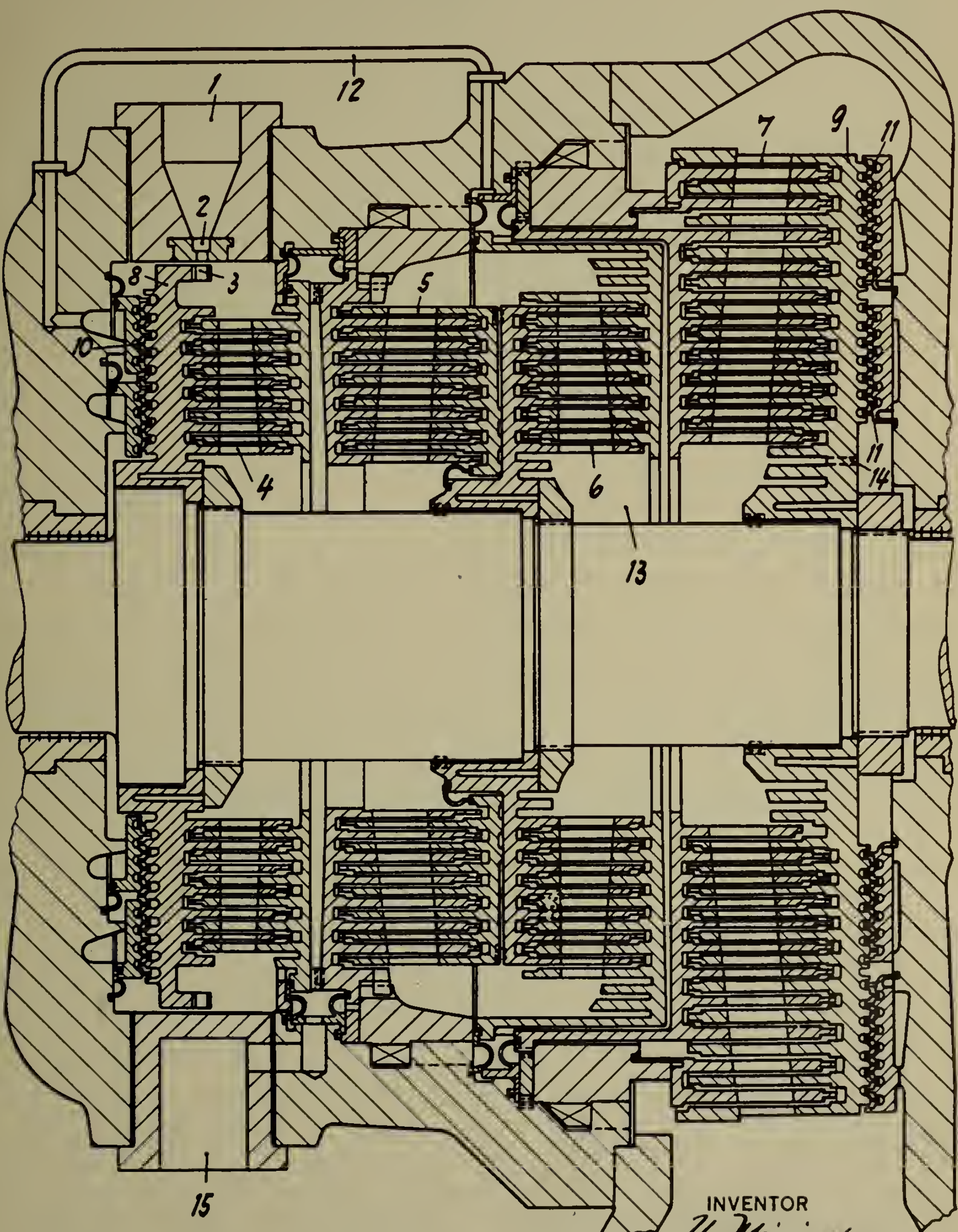
2 Sheets-Sheet 1

Fig. 1



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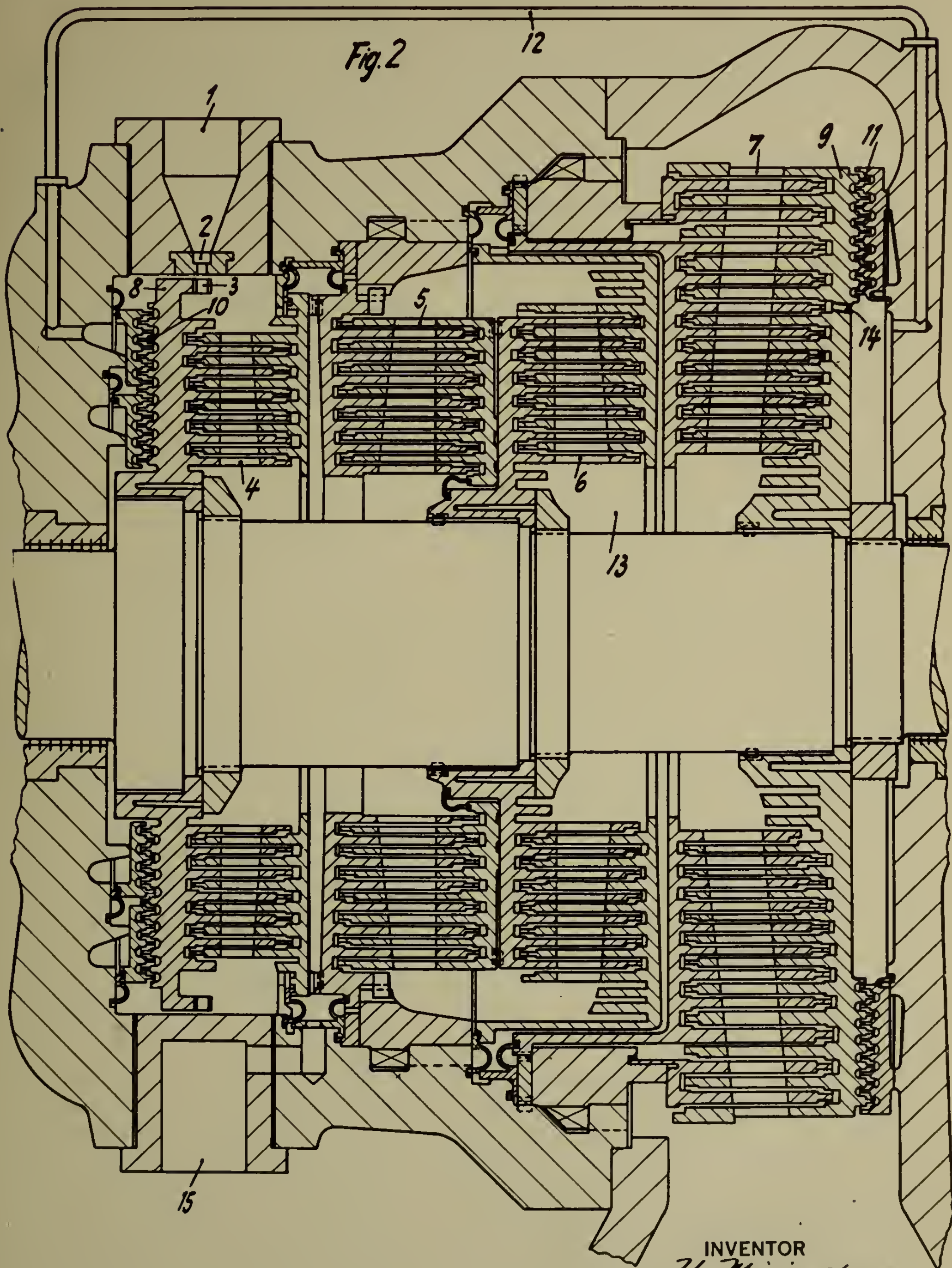

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ALIEN PROPERTY CUSTODIAN

ELECTRIC DEVICE AND METHOD FOR HEATING MATERIALS

Frans Michel Penning, Eindhoven, Holland; vested in the Alien Property Custodian

Application filed February 26, 1941

Electric furnaces are known in which materials are heated by high-frequency currents in a gaseous atmosphere of low pressure to very high temperatures. The equipment necessary for this purpose is rather expensive, we have only to think of the required generator. As a consequence thereof there exists the need of a less expensive electric furnace with which such heating operations can be carried into effect.

According to the invention, for heating materials above 750° C. the source of heat is furnished by a glow-discharge which takes place in a magnetic field which greatly lengthens the electron paths. This method permits us to obtain temperatures of the order of 2000° C. with an equipment which may be referred to as little expensive in comparison with the above-mentioned furnaces. Thus the magnetic field may be provided either by an electromagnet or by a permanent magnet while the heating operation may take place in a closed glass space. The gas in this space may have a low pressure.

It is already known to effect heating operations by means of a glow discharge. For example, it has previously been proposed to de-gas electrodes by means of a glow-discharge. When we desire to effect this heating at a higher temperature we encounter the drawback that the glow-discharges too readily pass into arc discharges, due to which the heating is concentrated at a single point and, besides, the energy greatly decreases since the arc discharge has a much lower operating voltage than a glow-discharge.

If now the paths along which the electrons travel from the cathode to the anode are greatly lengthened by a magnetic field, this will be found to have a stabilizing effect on the glow-discharge and, besides, to create the possibility of heating the cathode for a longer time to high temperatures. A further advantage is that with the same supply of energy as otherwise would be required for the glow-discharge lower gas-pressures and lower voltages may be utilised. More particularly the latter fact augments the possibility of application of the invention. It is obvious that the strength of the magnetic field must be efficiently chosen in connection with the voltage existing between the electrodes and with the pressure of the gas. It is, of course, a requirement that the radius of the arc according to which the electrons are deflected under the influence of the magnetic field should be of the same order of magnitude as or smaller than the length of the free path between the gas molecules.

The above-mentioned method may be carried out in different ways. Thus, the heating device may be constructed as a furnace and the body to be heated may be given the shape of a vessel in the hollow interior of which are provided the materials to be heated, melted or vaporised. It is also possible to utilise the body to be heated as a radiator of light and to use the device as a lamp. Finally the method may also be utilised for heating electrodes for a long time to a high temperature in order to remove occluded gases to a satisfactory extent.

In the above-mentioned cases the body to be heated or the furnace may be arranged, if desired, in a space of reduced gas-pressure. The arrangement should preferably be such that the gas-pressure in this space may be varied and may be adjusted during the glow-discharge to the most favourable value. This affords the further advantage that the glow-discharge can be more easily ignited at a higher pressure whilst, once ignited, it may be continued at a low pressure. Besides, during the glow-discharge all the gas may be pumped off, during which operation the discharge is extinguished, it is true, but the heated object still remains for sometime in vacuo at a high temperature. For the purpose of regulating the pressure it is often efficacious to cause the gas continually to flow-in on the one side of the tube and to pump on the other side. Besides, in this way a continual renewal of gas takes place, which may be desired in those cases wherein during the heating many contaminating gases are set free.

According to one form of realisation of the method according to the invention the glow-discharge is caused to take place in helium of low pressure for as compared with most other gases the cathode volatilisation is in helium very slight.

The invention will be explained more fully with reference to the accompanying drawings in which:

Fig. 1 represents diagrammatically a concentrically arranged cathode and anode and the course of the electron paths between them.

Fig. 2 diagrammatically represents the cathode and anode according to Fig. 1 and the electron paths as produced under the influence of a magnetic field perpendicular to the plane of the drawing.

Fig. 3 is a lateral elevation of Fig. 2.

Fig. 4 shows the arrangement of a modified form of cathode with a cylindrical anode, part of the operative surface of the cathode being cut by the lines of force of the magnetic field.

Fig. 5 represents a cylindrical cathode, an

anode arranged outside thereof and a magnetic field which is perpendicular to the axis of the cathode.

Fig. 6 shows a cathode formed as a vessel and surrounded by a cylindrical anode.

Fig. 7 represents a furnace according to the invention.

Fig. 8 is a different form of construction of the cathode in the furnace according to Fig. 7.

Fig. 9 represents a discharge tube having arranged in it an auxiliary electrode by which the removal of occluded gases from the anode is rendered possible.

Fig. 1 diagrammatically represents a cylindrical cathode **10** and a cylindrical anode **11** which are coaxially arranged in a gaseous atmosphere of low pressure. If a voltage is applied to these electrodes the electrons proceeding from the cathode travel in vacuo according to the radially extending lines. In the presence of gas they collide with a gas atoms; with a low-gas pressure the path of an electron may assume, for example, due to a collision at A, the shape indicated by a dotted line. If the anode voltage is high enough ionisation may occur upon these collisions; the positive ions formed are drawn to the cathodes and may set free therefrom not only the electrons required for their neutralisation but also further electrons. Assuming that an electron starting from the cathode forms on an average n ions on its way to the anode, an independent discharge will occur when these n ions set free together one additional electron from the cathode. During this discharge there occurs in the cathode a luminous phenomenon from which this discharge derives the name of glow-discharge. This luminous phenomenon is due to the lighting-up of the atoms hit by electrons. Owing to the frequent collisions of ions against the cathode the latter is heated more and more. When the energy supplied to the discharge increases, the possibility of the discharge passing from a glow-discharge into an arc discharge steadily increases. During the arc discharge the heating will be concentrated rather at a single point whilst the energy greatly decreases since the arc discharge has a much lower operating voltage than the glow discharge. The cathode is therefore heated to a much lower temperature.

In Fig. 2 the course of the electron path in vacuo is indicated by a curve B with the same cathode **10** and anode **11** as are shown in Fig. 1. The difference is, however, that this cathode and this anode are arranged in a magnetic field whose lines of force are perpendicular to the plane of the drawing (the crosslets indicate where the lines of force cut the plane of the drawing). Due to this magnetic field the electrons undergo a strong deflection from the rectilinear path which they would attempt to follow under ordinary conditions. They are deflected according to a curve B whose radius of curvature depends at any point on the voltage between the electrodes and on the strength of the magnetic field. If the space is filled with gas of a very low pressure, these factors may advantageously be so chosen that this radius of curvature becomes of the same order of magnitude or small with respect to the length of the free paths between the gas atoms. Owing to this, the electron, for example after having left the cathode, will describe through the magnetic field a path towards the anode as is diagrammatically shown in Fig. 2 by a dotted line. It may be seen how the electron successively collides in its path with gas atoms C, D and E. Since in these collisions the electron energy it can no longer reach the cathode whilst, on the other hand, it is prevented by the magnetic field from attaining the anode. In this way it may take a very long period of time before the electron has lost sufficient energy to reach the anode. This path is considerably longer than that in Fig. 1 so that also considerably more collisions with the gas atoms take place and consequently with lower voltages and a lower gas-pressure the same heating of the cathode may be attained and, besides, it is achieved that the glow discharge is stable and has little tendency to pass into the arc discharge.

Fig. 3 shows in lateral elevation the arrangement of Fig. 2. Moreover, the magnetic lines of force are indicated by arrowed lines **12** which extend parallel to the cathode. When an electron acquires a speed component parallel to the magnetic field this component is not influenced by the magnetic field. So long as the electron makes no collisions it consequently moves in a spiral path around a magnetic line of force and thus it may leave the discharge space. In order to prevent this Fig. 4 shows a shape of cathode **14** which is provided with flanges **15** and is arranged coaxially with respect to an anode **16**. The magnetic lines of force are parallel to the axis of the cathode and cut the operative surface at the point **17** where they enter into the discharge space and at the point **18** where they leave said space. Owing to the latter fact the electrons which should have the tendency indicated in Fig. 3 will when approaching the cathode wall, travel again in the opposite direction while moving around the lines of the magnetic field and travel in a zig-zag line between the flanges of the cathode to the anode. It is clear that the paths of these electrons are considerably lengthened and that consequently the possibility of collisions with atoms is appreciably increased.

Fig. 5 represents a further form of construction wherein an anode **20** is arranged outside a cylindrical cathode **21**. The lines of force **22** of the magnetic field are perpendicular to the axis of the cathode. If desired, the cathode may also be given the shape of two plates arranged opposite one another, the magnetic field being perpendicular to these plates.

Fig. 6 represents a cathode 25 which essentially is formed with flanges as is the cathode **14** of Fig. 4 but, in addition, it has a central cavity 23 in which may be introduced a material which is heated by heat delivered by the cathode. Fig. 7 represents a heating furnace equipped with a cathode which offers these possibilities. The discharge tube consists of a wall 30 of pyrex having scaled into it a stem **31** on which is mounted a cathode 32 provided with a cavity. The cathode is surrounded by an annular anode **33** which is led out of the tube by a conductor 34 and is maintained in its position by supporting wires 35. The pinch **31** and the conducting wire **36** of the cathode are further surrounded by a tube **37** of quartz which safeguards the pinch against arcing. The material to be heated **38** is introduced through an aperture 39 into the cathode 32 whereupon the interior space of the tube 30 is filled with gas of low pressure. The tube 30 is placed in a cooling vessel **41** provided with a supply conduit 42 and a discharge conduit **43** and is further surrounded by a coil 44. In connection with the gas-pressure prevailing in the tube and with the voltage to be applied between leading-in wires **34** and **40** the magnetic field

set up by the said coil may be so chosen that the paths of the electrons are considerably lengthened. Due to the glow-discharge produced the cathode is very strongly heated and temperatures above 1000° C., if desired even temperatures of about 2000° C, may be attained, this heat being delivered to the material **38** which liquefies or vaporizes. In order to ensure that the cathode can sustain these temperatures it is made, for example, of graphite. It is efficacious to utilize in this heating a filling of helium, preferably at a pressure of 5 mms at the most since in helium volatilisation of the operative cathode wall occurs to a less extent. The arrangement of Fig. 7 is utilised, for example, for applying the material vaporised in the cathode **32** by vaporisation to a body **45** which is also mounted in the tube by means of a supporting wire **46**. It is obvious that the tube must be of other construction if we intend to effect fusions of metals within the cathode **32** for in such cases it is necessary that the molten material can be easily removed from the cathode **32** or that the whole of this cathode is detachably mounted on the supporting rod **36** and may be removed through the aperture **39** from the tube **30**. It is also possible to modify the pressure of the gas within the tube **30**. For example, at the outset a higher pressure may be taken in order to effectuate a more easy ignition of the glow-discharge. When this discharge has once been ignited the pressure may be reduced. It is also possible to provide the tube **30** in addition to the outlet aperture **39**, with an inlet aperture **48** (indicated by dotted lines), owing to which renewal of the gas may be realised by the continual supply and discharge of gas.

Fig. 8 represents a cathode **50** which constitutes a variant of the cathode **32**.

Fig. 9 represents a discharge tube comprising an incandescent cathode **51** and two plate-shaped anodes **52**. When it is desired to de-gas these anodes **52** in the manner indicated above, this may be effected by means of a magnetic field **54** which is directed perpendicularly to the plates **52**. By temporarily connecting the cathode **51** as an anode and the plates **52** as a cathode, the latter plates will be strongly heated, during which heating degassing may take place.

FRANS MICHEL PENNING.

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MAY 25, 1943.

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ELECTRIC DEVICE AND METHOD FOR HEATING MATERIALS

Filed Feb. 26, 1941

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2 Sheets-Sheet 1

Fig. 1.

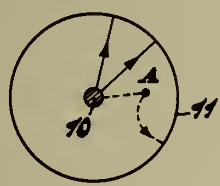
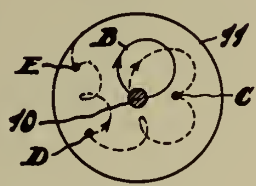


Fig. 2.



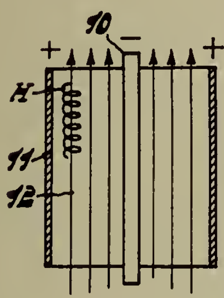


Fig. 3.

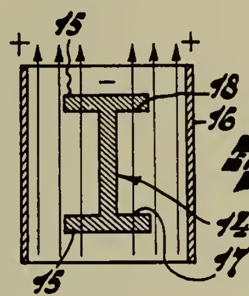
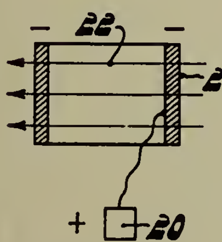


Fig. 4.



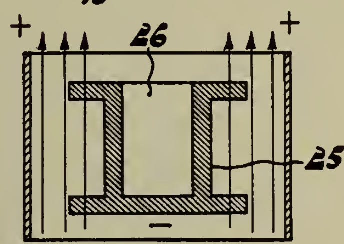


Fig. 5.

Fig. 6.

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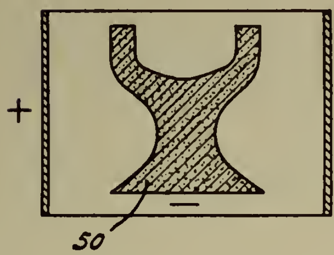

Fig. 8

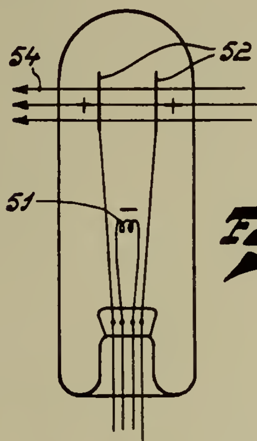

Fig. 9

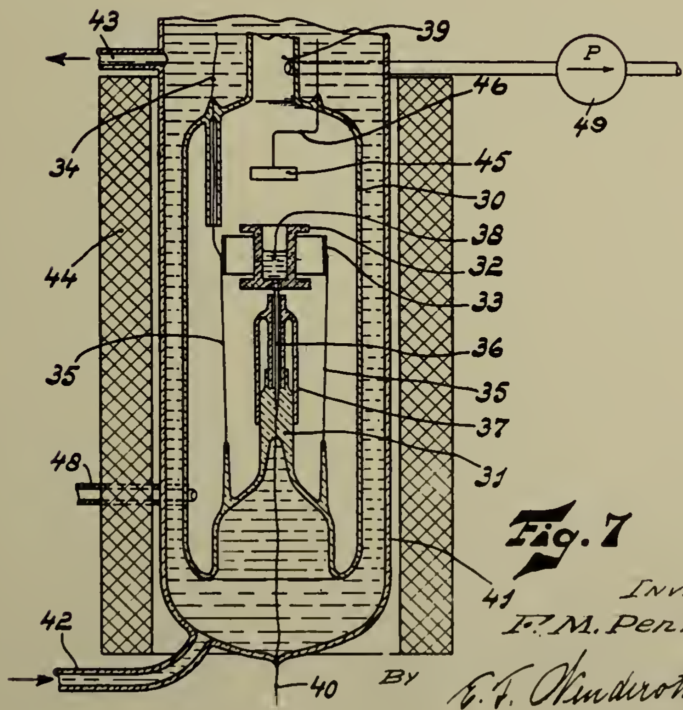

Fig. 7

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DEVICES FOR CONTROLLING THE BRAKE ACTION IN RAILWAY CARS AND THE LIKE

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Application filed February 28, 1941

It is known that when, on braking railway trains, the speed of the train decreases after the commencement of the braking action, as does, therefore, also the sliding speed at the friction surfaces of the brakes, the coefficient of friction and, thus, also the brake action increases. This takes place in an extraordinarily strongly increasing measure before the train concerned comes to a standstill, so that if the pressure forcing the friction bodies pressed against one another would remain constant the car wheels would be blocked and the train, moreover, come to a standstill with an undesired jerk. The chief conductor is not in the position to obviate that at all events in that he lacks, when actuating the control device for the brakes, completely any feeling for the actually effected brake action which depends not only upon the position of the brake control lever, but also upon the coefficient of friction which as mentioned above varies with the friction speed. The chief conductor does not know, therefore, at which point of time and in which measure he must adjust the brake lever to a lower brake action when the speed of the train decreases.

It has already, for the purpose of preventing the so-called blocking of the wheels of railway cars, as takes place in consequence of too strong braking, been suggested to make the brake pressure automatically dependent on factors connected with the actually arising brake action, as, for instance, on the state of motion of the braked wheel or on the speed of the respective train, as well as on the pressure existing in the brake cylinders.

The known devices hitherto suggested do not, anyhow, enable the chief conductor to adjust the maximum of brake action attainable with the automatic brake control at any desired time, for instance corresponding to the state of the rails at the time being (moisture, covering with ice). In order to provide also for such an adjustment, the control of the pressure medium (for instance compressed air) operating the brakes is effected, according to my invention, by the co-operation of two controlling members, of which the one, as regards its position, depends upon the position of a brake part which takes up the brake power and is elastically supported. This member is termed "torque meter" in the following part of this specification and in the claims. The position of the other controlling member is determined by an adjustment of the main switch to be actuated by the chief conductor, in such a manner, that the maximum value of the brake action can be adjusted from the cabin of the chief conductor at liberty corresponding to the varying conditions (wetness, covering with ice) without any detrimental influence upon the automatic regulation.

My invention is illustrated by way of example on the accompanying drawings, on which

Fig. 1 is an embodiment of a railway carriage brake according to the invention in axial section through the lower half of the brake.

Fig. 2 shows a section of a detail taken at right angles to that of Fig. 1.

Figures 3 and 4 are respectively an end view and a sectional view of a device for automatically regulating the torque in the brake illustrated in Fig. 1.

Fig. 5 is a diagrammatic view showing the device illustrated in Figs. 3 and 4 connected up to the embodiment shown in Fig. 1.

In the drawings, 1 denotes the wheel of a railway vehicle, 2 denotes a member rigidly connected with the axle bearing or with the underframe of the vehicle, and 3 denotes the axle.

As may be seen from Figure 1 there is secured to the wheel 1, by the aid of massive bolts 17, an annular hollow body which is denoted as a whole by E, and which is composed of three parts, namely the substantially disc-shaped end parts E_1, E_2, and an annular part E_3 connecting them with one another. These three parts form together an annular casing, which is closed, except for an annular gap 4 between the inner periphery of the disc portion E_1 and the hub D_3 of an annular body D, which is so connected with the part 2 of the axle bearing as to be rotatable only within certain limits. The body D forms the carrier of one group 14 of friction discs. The discs 14, which are arranged alternately with discs 11 in two packets separate from one another, are guided by ribs or ledges 18a, projecting from the internal surface of the middle part E_3 and extending in an axial direction, the discs 11 being guided upon similar ribs or ledges 12a, which project outwards from the second disc carrier C. This carrier, which will hereinafter be referred to as the loose carrier, is rotatable without limit both in relation to the wheel 1 and its axle and in relation to the axle bearing 2, and therefore in relation to the vehicle underframe. The loose carrier may be supported by the aid of running rollers 29 distributed around its periphery, on the outer or fixed carrier E, and the running rollers 29 supporting the two disc carriers being mounted by means of ball bearings on

studs 30 fixed on the disc-shaped parts E_1, E_3 of the carrier E so as to extend axially inwards.

The loose carrier, denoted as a whole by the reference C, is likewise composed of a central annular portion C_3 and two side members C_1 and C_2. The lastnamed parts, which also comprise the ledges of ribs 12*a* for guiding the discs 11, are of stepped cross section, which is symmetrical about a central plane at right angles to the axle 3, and are guided on the central part C_3 by their outer flange members 13 by the aid of bolts 13*a*, in such a way that they can slide axially in relation to the latter but cannot rotate. Opposite to the inner flange members c_1, c_2 of the loose carrier C are located pressure appliances B, which effect the compression of the packets of discs in an axial direction. The pressure appliances B are distributed in pairs opposite to one another over the periphery of the annular body D connected with the axle bearing 2. They consist of hollow cylindrical bellows of thin sheet metal, the interiors of which communicate by a common pipe 25 with a supply 7 for the pressure fluid, for instance compressed air. The bellows B do not act directly upon the flange members c_1, c_2 but through the medium of annular discs 20, which are so guided, by the aid of bolts mounted on the carrying body D and extending in an axial direction, that they can slide axially but cannot rotate relatively to the carrying body D.

Upon the periphery of the carrying body D are arranged pressure appliances A, which consist of pistons 95 (Fig. 2) operating in cylinders 96 communicating with the pressure medium, for instance compressed air through pipes 36.

The pistons are urged towards the axle by means of springs 97. At the free end of the piston rod 98, a wedge 99 is provided which passes between two projections 100, 100 having correspondingly inclined surfaces on the brake blocks 8, 8 which are in the form of annular sectors. These brake blocks are provided with friction pieces 9, 9, also in the form of annular sectors. When the pistons 96 are forced outwardly in the direction of the arrow by the introduction of pressure medium into the cylinders 95, thereby expanding the brake blocks 8, the friction pieces come into frictional engagement with co-operating friction surfaces on an annular central part C_3 of the loose disc carrier C, whereby the braking of the loose disc carrier is effected. If the connection of the cylinders 95 with the source of pressure medium is interrupted and the pipes 36 placed into communication with the atmosphere, then the springs 97 force the pistons 96 back into their initial position, the brake blocks being retracted through the intermediary of pins 37 which pass through the wedges 99 which bear against projections 38 on lugs provided on the brake blocks.

The braking of the loose carrier is effected shortly before the pressure appliances formed by the bellows B come into operation for the compression of the packets of friction discs, and independently of the latter. For this purpose the compressed air ducts leading to the pressure appliances A and to the pressure appliances B lead independently of one another through the carrying body D and the axle bearing 2 to a control appliance supervised by the driver of the vehicle. By a further pipe, not shown in the drawing, a cooling medium is supplied to the friction discs, this cooling medium following the paths indicated by the two arrows, through two groups of ducts 28 distributed over the periphery in the side members C_1, C_2 of the loose carrier.

As has already been indicated above, in describing the construction according to Figure 1, that the annular body D is rotatable to a certain limited extent relatively to the axle bearing member 2. This is rendered possible by the fact that the part D'_3 of the hub is supported for instance by means of a bronze bush 73 upon the sleeve member D_3 and is provided with pins 70 projecting axially and distributed round the periphery, these pins alternating with a corresponding number of stops 71, likewise distributed round the periphery on the flange, screwed to the axle bearing member 2 of the sleeve body D_3. Between each pin 70 and the adjacent stop 71 is interposed, as indicated in a more diagrammatic manner by Figure 3, a helical spring 72. These springs oppose a resilient resistance to a rotation of the part D'_3 of the carrying body in relation to the part D_3 connected with the axle bearing, and ultimately restrict such rotation definitely when they are fully compressed.

At one place on the periphery there is provided, between two outwardly extending arms 74 and 75 connected on the one hand with the body D'_3 and on the other hand with the body D_3, a pressure appliance F consisting of spring sheet metal bellows, the hollow interior of which is in communication by a flexible pipe 76 with a controlling appliance H mounted on the underframe of the car.

One arm 74 comprises a stud screwed into the annular body D and passing through an arcuate slot 74' in the bearing part 2 and through an arcuate slot 71*d* in the stop 71 adjacent thereto. This stud at its outer part forms an abutment for a pressure device F (Figs. 3 and 4) which consists of a resilient sheet metal bellows, the other abutment of which is formed by the arm 75 rigidly connected to the body D_3.

The controlling appliance consists essentially of a three-stage cylinder member 77, in which there work two piston valves, namely an outer annular piston 78 and an inner piston 79. The latter is subject to the action of a bellows 80, which is connected with the pipe 76, and which, when it expands owing to a rise of air pressure in the pipe 76 caused by compression of the bellows F (Fig. 3), presses the piston 79 downwards against the action of a spring 81, which urges it upwards. The piston 78 is subject on one side to the action of bellows 82, the interior of which communicates by a pipe 84 with the brake switch on the driver's switch board, and on the other side to the action of a spring 85, which tends to move the piston in the opposite direction.

Two bores 78*a* and 18*b* of the piston 78 are connected to flexible pipes 91 and 86 respectively, of which the latter comes from the source of compressed air, while the pipe 91 leads to the bellows B of the brake, which effect the axial compression of the packets of discs. The pipes 86 and 91 pass freely through elongated holes 90 provided in the wall of the cylinder 77. The inner piston 79 is provided with a transverse bore 87, which is of greater diameter than the bores 78*a* and 78*b* located opposite to it in the outer piston 78. The piston 79 also has a bore 89, the axially directed portion of which opens freely into the interior of the cylinder 77, which in its turn communicates through openings 77*a* with the atmosphere. The horizontal portion 89*a* of this bore opens in the peripheral surface of the piston. It may register in a definite relative position of the pistons 78 and

79 with the horizontal portion 88*a* of a bore provided in the piston 78, this bore terminating in the bore 78*a* or in the pipe 91 connected thereto. The pipe 91 is flexible and is attached to a hollow projection 7*a* forming a continuation of the supply conduit 7 and passing through an arcuate slot 71*c* in the bearing part 2 and a corresponding arcuate slot in the stop 71 adjacent thereto, the said slots being of sufficient length to permit the requisite amount of relative movement between the parts D and D_3.

The device illustrated in Figures 3, 4 and 5 is designed to solve the following problem: The driver of a railway vehicle equipped with the brakes described adjusts the pressure in the bellows B, by the aid of a main controlling appliance or switch L directly operated by him by means of a control lever J, in the manner required for the braking action desired at the particular time, this being determined in general by reference to a scale or the like, with which the control lever J manipulated by him co-operates. Now it is known that if, after the braking action has started, the speed of the train, and therefore also the speed of slipping between the friction discs of the brakes, diminishes, the frictional value increases, and with it the braking action also. This occurs in jerks shortly before the train comes to a standstill, so that if the pressure compressing the friction discs remains constant, the wheels of the coach would become locked, and in addition the train would come to a standstill with an undesirable jolt. The driver cannot directly prevent this, because in operating his controlling appliance L, he has no means of ascertaining by the feel of nature of the braking action actually produced, which depends not only upon the position of the brake control lever J but also upon the coefficient of friction, which in its turn varies with the rubbing speed. The driver therefore does not know when and to what extent he must adjust the brake lever to a lower braking effect when the speed of travel is diminishing.

This adjusting of the braking action in dependence upon all factors that might affect the coefficient of friction, is automatically effected by the device described, which is illustrated in Figures 3, 4 and 5.

In connection with these figures, it is further pointed out that the controlling device L is in communication through the pipe 92 with a source of compressed air (not shown) and is in communication with the atmosphere through the pipe 93 and through the pipe 84 with the bellows 82, 82 of the controlling device H. The pipe 86 of the controlling device H is connected up to a compressed air reservoir.

The automatic adjusting before mentioned occurs in the following manner: As soon as the brake is switched on by means of the lever J by admitting compressed air to the bellows B, a relative rotation of the members D_3 and D'_3 takes place, with compression of the springs 72. The bellows F are also compressed by the projections 74 and 75. The raised air pressure thereby produced is transmitted by the pipe 76 to the bellows 80, which in their turn displace the control piston 79 against the pressure of its spring 81, and, after traversing a certain displacement distance, during which the passage, supervised by the bore 87, of compressed air from 86 to 91, is at first set completely free, but finally occasions the complete closure of the pipe in question leading to the brake. In this position the adjacent horizontal portions of the bores 88 and 89 also do not register with one another, so that this branch pipe leading to the atmosphere is likewise shut off. Now if the torque in the brake on account, it may be, of the increase in the coefficient of friction, further increases, the control piston 79 is pressed further down, with the result that the transversely extending portions of the bores 88 and 89 register with one another. The pipe 91 is thereby connected with the atmosphere. The compressed air can escape from the bellows B and relax the braking action. Consequently the springs 72 recover their predominance over the frictional torque, so that the members D_3 and D'_3 are further rotated relatively to one another in the other direction. The bellows F are thereby relieved, the spring 81 can push the control piston 79 back again, so that the passage at 87 is set free again, and compressed air is admitted afresh to the brake, since in the meantime the pipe 88, 89 leading to the atmosphere has been interrupted again. The braking action therefore increases again. This series of operations is repeated until the piston 79 finally comes to rest in an intermediate position. This automatic regulating of the braking torque is independent of the adjustment of the braking action on the part of the train driver, since it occurs in any position of the intermediate piston 78 by which the desired braking action in itself is conditioned. The driver therefore need only adjust the braking action that he considers necessary for the purpose of bringing the train to a standstill at a definite point on the brake lever manipulated by him, which co-operates with a scale of braking action. In each of these adjustments the automatic adaptation of the braking effect concerned to the changing frictional conditions can then take place.

It may also be observed that the rotation, occurring when the torque increases, which is utilized for the automatic regulating of the pressure acting upon the packets of friction discs, need not necessarily take place between the members D_3 and D'_3. It may alternatively be provided between other links in the kinematic chain between the rotating member to be braked, that is to say, the wheel 1, and the fixed member, namely the axle bearing 2 or the car frame. This kinematic chain in the claims will be named: torque meter.

Of course the brake devices illustrated, as such, may also be employed for other purposes, particularly where the braking of large and rapidly moving masses is important, as for instance in the case of heavy high-speed vehicles.

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DEVICES FOR CONTROLLING THE BRAKE ACTION IN RAILWAY CARS AND THE LIKE

Filed Feb. 28, 1941

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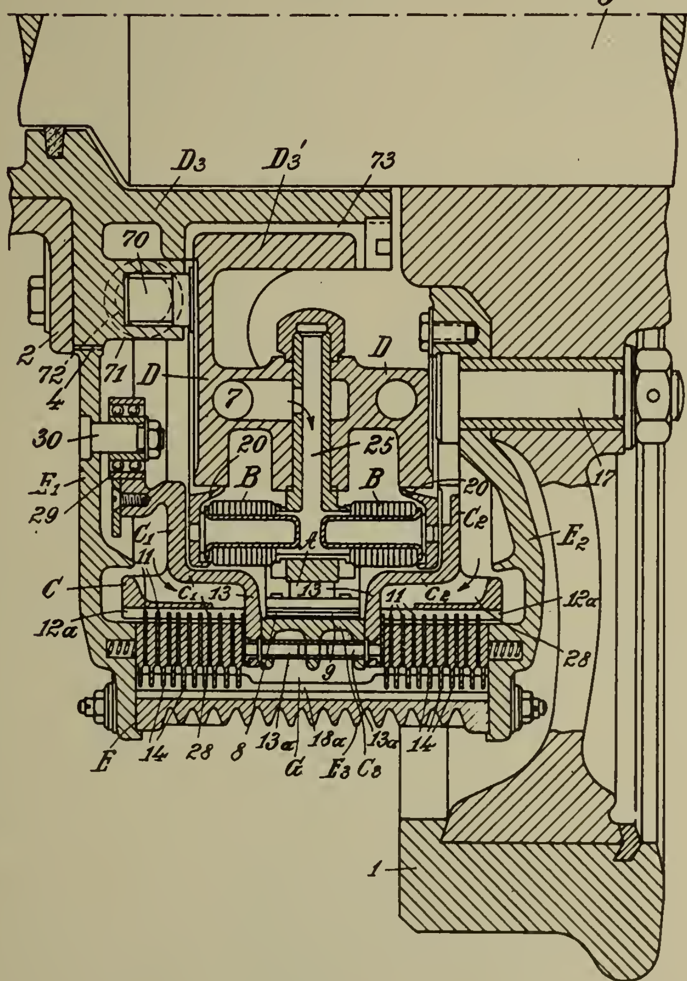
3 Sheets-Sheet 1

Fig. 1



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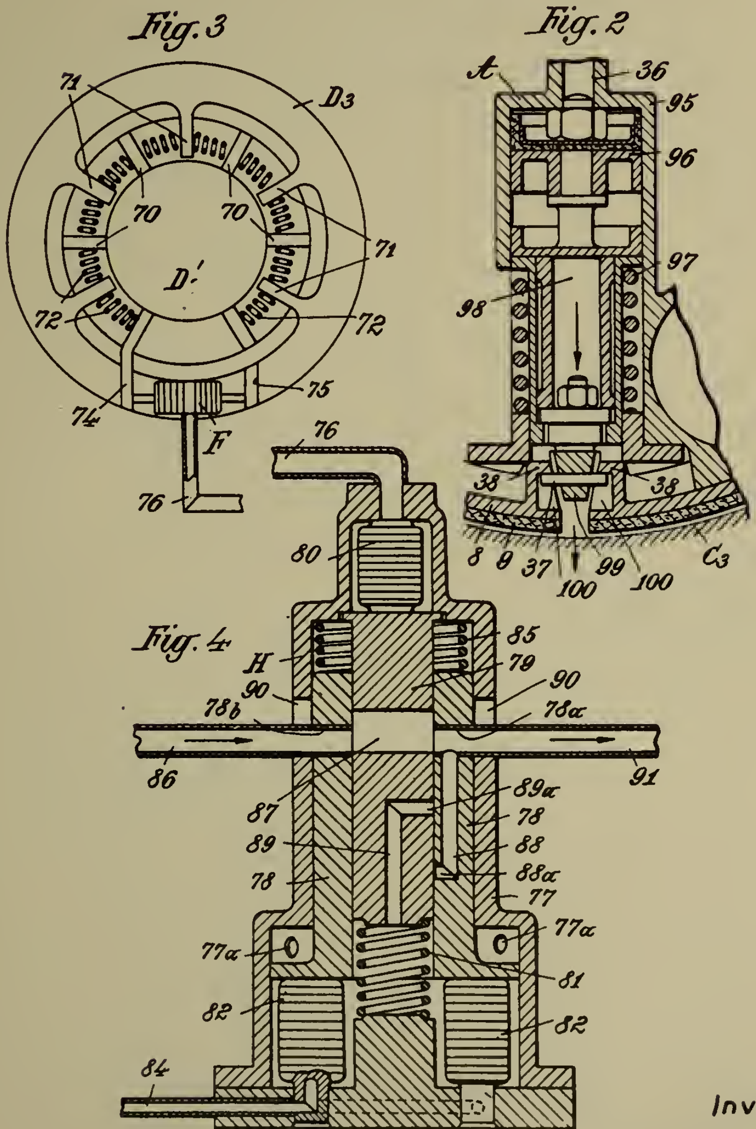
3 Sheets-Sheet 2



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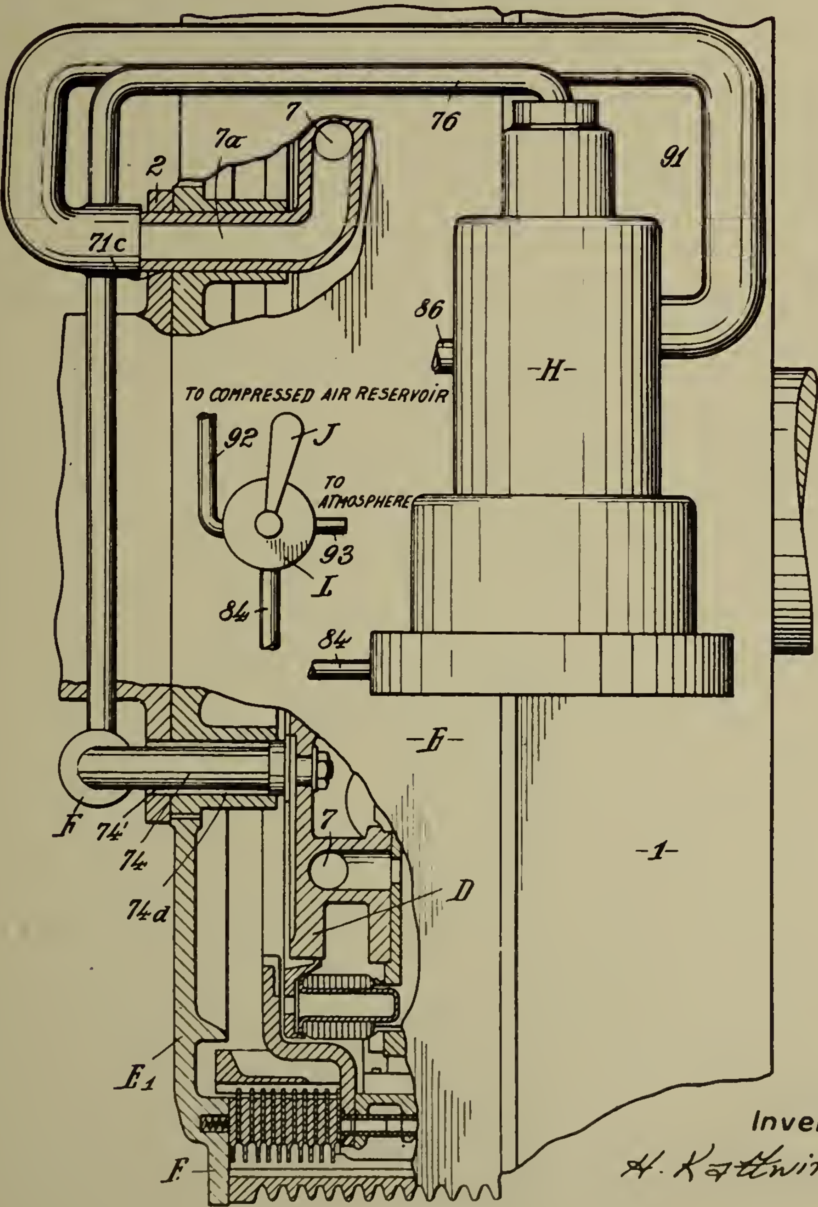
3 Sheets-Sheet 3

Fig. 5



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ALIEN PROPERTY CUSTODIAN

INDEPENDENT WHEEL SUSPENSION

Siegfried Wulff, Stuttgart-Bad Cannstatt, Germany; vested in the Alien Property Custodian

Application filed March 1, 1941

The present invention relates to an independent wheel suspension provided with a pivot, resiliently mounted at the frame and supporting the guide members. More particularly, the invention is concerned with an independent wheel suspension for motor cars in which the guide members for instance two guide links arranged one above the other and serving to guide the wheel, are supported by a pivot which for instance may yield about a vertical axis and is mounted substantially vertically on the frame. In wheel suspensions of this kind it is difficult to so exactly construct the individual members of the frame and of the wheel suspension that, after assembling the vehicle frame, the arrangements of the wheel suspensions of the two wheels of a pair of wheels are consistent to each other and that the wheels or the steering swivel journals of same respectively occupy a strictly equal and prescribed position. If this is not the case, an undesired non-uniform guidance of the two wheels may under circumstances occur by which the position of the vehicle relatively to the rod and the safety of steering are influenced.

Now, the object of the invention is to provide an arrangement which allows a simple and suitable adjustment of the supporting pivot and thereby of the wheel suspension. Simultaneously the invention ensures a safe and suitable absorption of all forces occurring at the supporting pivot.

The invention consists in journalling the vertical supporting pivot in adjustable bearings on the frame, more particularly in such a manner that the axial direction of the supporting pivot may be adjusted. To this end the bearings for the supporting pivot for instance are provided with ball-like bearing surfaces and may be adjusted in a transverse direction or they are so formed that they may later on, during mounting of the supporting pivot on the frame, be connected to the latter in an adjustable position. Owing to the ball-like bearing surfaces of the bearings the pivot may unconstrained and freely adjust itself in any position. Preferably the bearings simultaneously serve the purpose of absorbing axial forces occurring at the supporting pivot. The one bearing preferably comprises a ring, having a ball-like bearing surface, which, by means of a nut screwed upon the supporting pivot, is pressed in axial direction against the correspondingly ball shaped bearing surface at the frame.

The present invention, furthermore, relates to a resilient mounting of the supporting pivot according to which the pivot is journalled at the frame by means of a rubber sleeve surrounding the pivot and a metal sleeve surrounding the rubber sleeve and adapted to be inserted into the frame. Hereby the rubber may be biased and adherently connected to the metal members making contact with this rubber sleeve. By this arrangement, allowing a simple assembly and a simple adjustability, any transmission of shocks upon the frame is practically obviated. More particularly, it is hereby easily possible to obtain an arrangement in which the supporting pivot may be mounted on the frame in a manner to yield in all directions in which, however, resiliency mainly is given in the direction of rotation about the axis of the pivot. Moreover, the axial forces may be absorbed by the cooperation of the entire relatively long rubber sleeve. The adjustment of the supporting pivot preferably is effected by adjustment of the bearings provided at the frame for the metal sleeve.

Furthermore, of particular importance is an arrangement of the supporting pivot in such a manner that it vertically extends through a hollow member of the frame, for instance a vertical tube sleeve welded to a longitudinal beam and a transverse beam of the frame, whereby one or both ends of the tube- or box-like frame member may project beyond the plane of the frame to ensure safe mounting of the supporting pivot. Simultaneously a suitable stiffening or reinforcing of the frame is hereby obtained at that point at which the wheel forces are transmitted to the frame. Simultaneously the supporting pivot may in a simple manner be journalled and adjusted by providing the upper and lower side of the hollow frame member with horizontal flanges upon which the bearings for the supporting pivot are mounted in the manner of a cap or cover.

In the accompanying drawing two constructions according to the invention are shown by way of example.

In this drawing:

Fig. 1 shows a broken away view partly in section of a wheel suspension according to the invention, and

Fig. 2 shows a detail view of the mounting of the supporting pivot in vertical section.

The wheel support *a* is guided by the two guide links *b* and *c*. The upper link *b* and the lower link *c* are linked to an upper bearing member *d* and a lower bearing member *e* respectively. The bearing members *d* and *e* are rigidly connected to the vertical supporting pivot *f* which

is arranged in the frame in the manner to be described presently.

The frame consists of box-like longitudinal beams *g* and box-like transverse beams *h*. At the point of connection of the front transverse beam to the frame, a vertical tube member *i* is fixed by welding which upwardly and downwardly extends beyond the plane of the frame and the open ends of which are provided with horizontal flanges.

As may be seen from Fig. 1 the supporting pivot *f* extends in a vertical direction through the tube member *i* of the frame. The entire length of the supporting pivot *f* between the bearing members *d* and *e* is surrounded by a rubber sleeve *k* the lower end of which is provided with a ball-like collar *l*. The rubber sleeve *k* in turn is surrounded by a metal sleeve *m* provided with a lower ball-like collar surface *n*. The rubber sleeve *k* may, more or less biased, be inserted into the intermediate space between the pivot *f* and the metal sleeve *m*, or this rubber sleeve may adherently be connected, by a method known per se, to one or the other surface of the pivot or the metal sleeve in contact with it, or with both members respectively. To support the ball-like collar surface *n* of the metal sleeve upon the frame, a bearing o with a corresponding ball-like bearing surface is provided which in the manner of a cap or cover is mounted from below upon the lower end flange of the tube member *i* of the frame. The vertical forces occurring at the frame, particularly the weight of the car body and of the frame, are, by way of the supporting surface of the bearing o, transmitted upon the metal sleeve *m* and from there, by way of the rubber sleeve, upon the vertical supporting pivot. To axially fix the metal sleeve and thereby the supporting pivot, a nut *p* is screwed upon the upper end of the metal sleeve and this nut forces a ball-like intermediate ring *q* against a correspondingly formed bearing surface of a bearing *r* mounted upon the upper end flange of the frame sleeve or tube member *i* in the manner of a cap or cover. The cap-or cover-like bearings o and *r* are so arranged that their connection to the frame may be effected during assembling of the wheel suspension, so that inexactnesses in the manufacture of the frame may be compensated by a corresponding adjustment of the bearings *o* and *r* in a horizontal plane and by fixing these bearings in the adjusted position to the end flanges of the tube member *i*. The ball-like bearing surfaces of the collar *n* and the intermediate ring *q* respectively allow an unconstrained adjustment into any position of the metal sleeve *m* and therewith of the vertical supporting pivot *f*. The connection of the bearings o and *r* respectively to the lower and upper end flanges respectively of the tube member or frame sleeve *i* may be effected by screws, preferably, however, by welding, because after the assembly an adjustment as a rule is not required.

To absorb shocks of the wheel a coiled spring *s* is provided which is not guided and the ends of which bear against the lower guide link *c* and the bearing member *d* of the upper guide link *b* respectively. Within the coiled spring *s* for instance an hydraulic shock absorber *t* is mounted which for instance also carries a stop *u* for limiting the stroke of the wheel.

To support the pivot *f* about the vertical axis, the lower bearing member *e* is provided with arms which for instance in a manner known per se bear against rubber buffers *v* provided at the frame. The pivot *f* may, however, be supported about the vertical axis in any other desired member.

According to the construction shown in Fig. 2, illustrating only the lower bearing of the supporting pivot *f*, the metal sleeve *m* is mounted by means of its ball-like collar *n* in an eccentric oı serving as bearing which in the direction of rotation may be adjusted about its axis in the tube member or frame sleeve *i*. Depending on the eccentricity the position of the supporting pivot *f* may more or less be changed. As a rule, a slight adjustability will be sufficient. To fix the eccentric, a screw *w* for instance is provided which couples the eccentric in the desired position of rotation to the tube member or sleeve *i* or for instance to a cap *x* adapted to be rigidly connected to the sleeve *i*.

In the same manner the upper bearing *r* may be so constructed as to be capable of being adjusted. However, under certain circumstances it will be sufficient if one of the bearings only is adjustable in a horizontal plane. Instead of effecting the adjustment by an eccentric, an adjustment may, for instance, also be obtained by bearings which for instance may be transversely shifted in the manner of sliding stones. The arrangement may hereby be such, that one of the bearings, for instance the lower bearing, may be shifted transversely to the direction of drive and the other, for instance the upper bearing, in the direction of drive, whereby simultaneously an independent adjustment of the tread on the one hand and of the clearance angle of the steering swivel journal on the other hand is possible.

The adjustable arrangement of the supporting pivot may also be provided without the use of the intermediate rubber sleeve *k*. Moreover, the rubber members could be arranged outside the adjusting members, but the construction shown results in a particular suitable and simple arrangement. Eventually the rubber sleeve *k* may also be used in connection with supporting pivots which are not adjustable.

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INDEPENDENT WHEEL SUSPENSION

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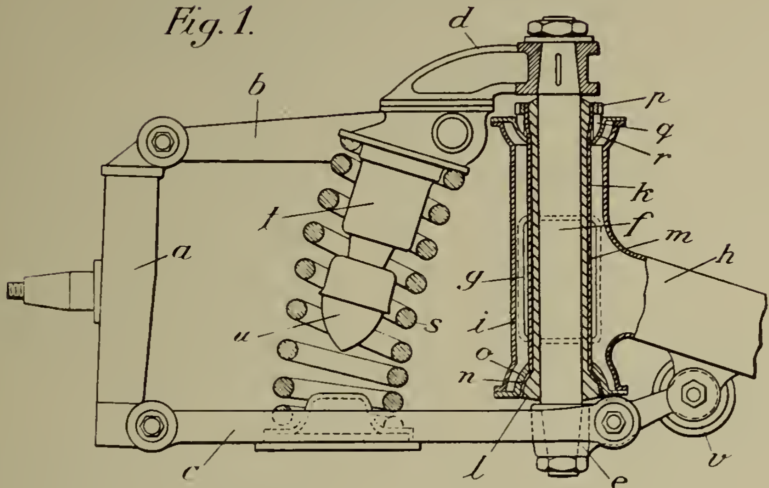
Fig. 1.



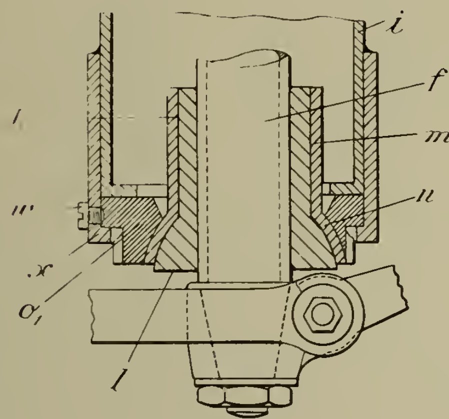


Fig. 2.

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ALIEN PROPERTY CUSTODIAN

WHEEL SUSPENSION FOR VEHICLES, ESPECIALLY FOR MOTOR VEHICLES HAVING A SUPPORTING MEMBER MOUNTED AT THE FRAME

Siegfried Wulff, Stuttgart-Bad Cannstatt, Germany; vested in the Alien Property Custodian

Application filed March 1, 1941

The present invention relates to a wheel suspension for vehicles, especially for motor vehicles having a supporting member resiliently mounted at the frame. More particularly, the invention is concerned with a wheel suspension for motor vehicles in which the wheel suspension members of at least two wheels, preferably of each wheel or a portion of same are mounted upon a supporting member, resiliently arranged at the frame, for instance upon a supporting pivot substantially resiliently mounted about a vertical axis.

The invention consists in this that the motor or eventually another driving aggregate (e. g. the differential) of the vehicle is mounted upon the preferably resiliently arranged supporting members for the wheel suspension members instead of upon the frame. Preferably elastic members are hereby interposed between the motor and the supporting members.

In contradistinction to the hitherto used arrangements in which the motor or other driving aggregates were mounted upon the frame, the construction according to the present invention has the advantage that vibrations of the motor or the corresponding other driving aggregate are transmitted not upon the frame but directly upon the supporting members serving for mounting the wheels. It is further of advantage that the weight of the motor may directly counter-act shocks and vibrations resulting from the rod so that the effect of these vibrations upon the frame is reduced. Hereby the frame on the one hand is released from the large strains occurring otherwise and on the other hand critical vibrations may be prevented without difficulty which otherwise often only may be controlled with difficulty and cause inconvenient vibrations phenomenons.

Other advantageous constructions of the wheel suspension according to the present invention may be gathered from the following specification:

In the accompanying drawing some embodiments of wheel suspensions according to the invention are shown by way of example.

In this drawing:

Fig. 1 is a diagrammatic view, partially in section of a front axle according to the invention,

Fig. 2 shows a plan view of the means for guiding the left-hand wheel,

Fig. 3 is a plan view in section on the line A—B of Fig. 1 showing the means for guiding the right-hand wheel,

Fig. 4 shows a modification of a wheel suspension according to the invention on a large scale and partially in section,

Fig. 5 is a plan view of the one end of the lower transverse member to be described later on, and

Fig. 6 is a section on the line C—D of Fig. 4.

In the construction shown in Fig. 1 the dirigible wheels 1 are carried by the wheel supports 2 which are connected by an upper link 3 and a lower link 4 as well as by joints 6 and 7 respectively to a vertical supporting pivot 5. The latter is mounted for instance by means of a rubber sleeve 8 in the frame 9 of the vehicle, the rubber sleeve allowing yielding of the supporting pivot mainly about its vertical axis. To absorb shocks of the wheel a spring, for instance a coiled spring 10 is provided which is not guided and the ends of which on the one hand bear against the lower link 4 and on the other hand against a bearing bracket 11 provided for example at the frame. To absorb the forces which tend to swing the wheel suspension about the axis of the supporting pivot 5, any desired means, a resilient member, for instance a leaf spring 2, may be provided which connects the two supporting pivots 5 at both sides of the longitudinal centre plane of the vehicle.

According to the invention the motor 13, moreover, is mounted upon a transverse member 16 by a fastening member, for instance by a front bearing eye 14 or a flange and an interposed rubber buffer 15. The transverse member 16 connects the upper ends of the supporting pivots 5 to each other. Between the transverse member 16 and the supporting pivots 5 other rubber blocks 17 are provided which particularly serve the purpose of compensating the movements resulting from the resilient mounting of the supporting pivots 5, the motor not being forced to follow these movements. The transverse member 16 also preferably is somewhat elastic, more particularly capable of being elastically bent, to still further reduce as far as possible the mutual influencing of motor and wheel suspension. To enlarge the resiliency the transverse member 16 may correspondingly be curved instead of being constructed in a straight line.

In the modification shown in Fig. 4 the elements also illustrated in Figs. 1–3 are designated with the reference characters used in Figs. 1–3 for such elements. In this case the two bearing members 18 and 19 are rigidly mounted upon the supporting pivots 5. The bearing member 18 serves for mounting the upper link 3 and the bearing member 19 for mounting the lower link

4. Moreover, a shock absorber 20 as well as an abutment 21 for the coiled spring 10 are also arranged at the upper bearing member 18.

Fixed upon the upper end of the supporting pivot 5 is an angle iron 22 which by way of the interposed rubber block 17 is adherently connected to another metal member 23. Connected to the latter is the transverse member 16 which is capable of being elastically bent and which is carrying the motor. The arrangement hereby is such that the rubber block 17 of substantially rectangular cross section between its connecting surfaces is obliquely inclined downwardly towards the centre longitudinal plane of the vehicle. The forces produced by the weight of the motor or other forces acting in vertical direction, therefore, substantially are absorbed by the rubber blocks 17, whereas the rubber block 15 allows substantially torsional vibrations of the motor. This rubber block is for instance in a manner known per se also arranged between metal elements and adherently connected to the latter. Vertical vibrations are absorbed by the transverse member 16 which is capable of being somewhat elastically bent. The resilient members 15, 16, 17 arranged between the motor 13 and the supporting pivots 5 are of sufficient resiliency in the horizontal direction to allow the required yielding of the supporting pivot 5, particularly the yielding about the vertical axis of the pivot, and to prevent shocks occurring at the wheel suspension to be transferred to the motor which would be highly undesired.

To ensure a safe mounting of the supporting pivot 5 on the frame allowing an adjustment, the rubber sleeve 8 surrounding the supporting pivot is inserted in a metal sleeve 24 which by means of a ball-like end surface 25 and a ball-like intermediate ring 26 respectively bears against ball-like bearing caps or covers 27 and 28 which are mounted upon the open ends of a vertical frame sleeve 29. The latter in turn is arranged at the point of connection of a transverse beam 30 of the frame to a longitudinal beam of the frame which for instance may also be of tube- or box-like formation. The frame sleeve 29 is welded to these frame beams to form a solid unit with same.

As may also be seen from Fig. 4, the lower transverse member 12, formed as a flat iron or a spring leaf and serving to support the two supporting pivots 5 relatively to each other, is rigidly connected to the bearing member 19 for the lower guide link 4. Accordingly the bearing member 19 has an inwardly directed flange 31 the lower surface of which is at 32 toothed or chequered in the longitudinal direction of the transverse member 12. The end of the transverse member 12 also is correspondingly toothed or chequered. By screws 33 the transverse member 12 is strongly pressed against the flange 31 of the bearing member 19 so that by means of the toothed or chequered part 32 a rigid coupling between these two parts is obtained in the direction of rotation about the axis of the supporting pivot 5.

Yielding of the wheel suspension about the vertical axis of the supporting pivot 5, therefore, is possible only by a bending of the transverse member 12 in a horizontal plane, i. e. by bending forces acting around the edge way upon the spring leaf 12.

It is understood that the wheel suspension members also may be mounted e. g. upon a U-shaped forging instead of on the supporting pivots above described.

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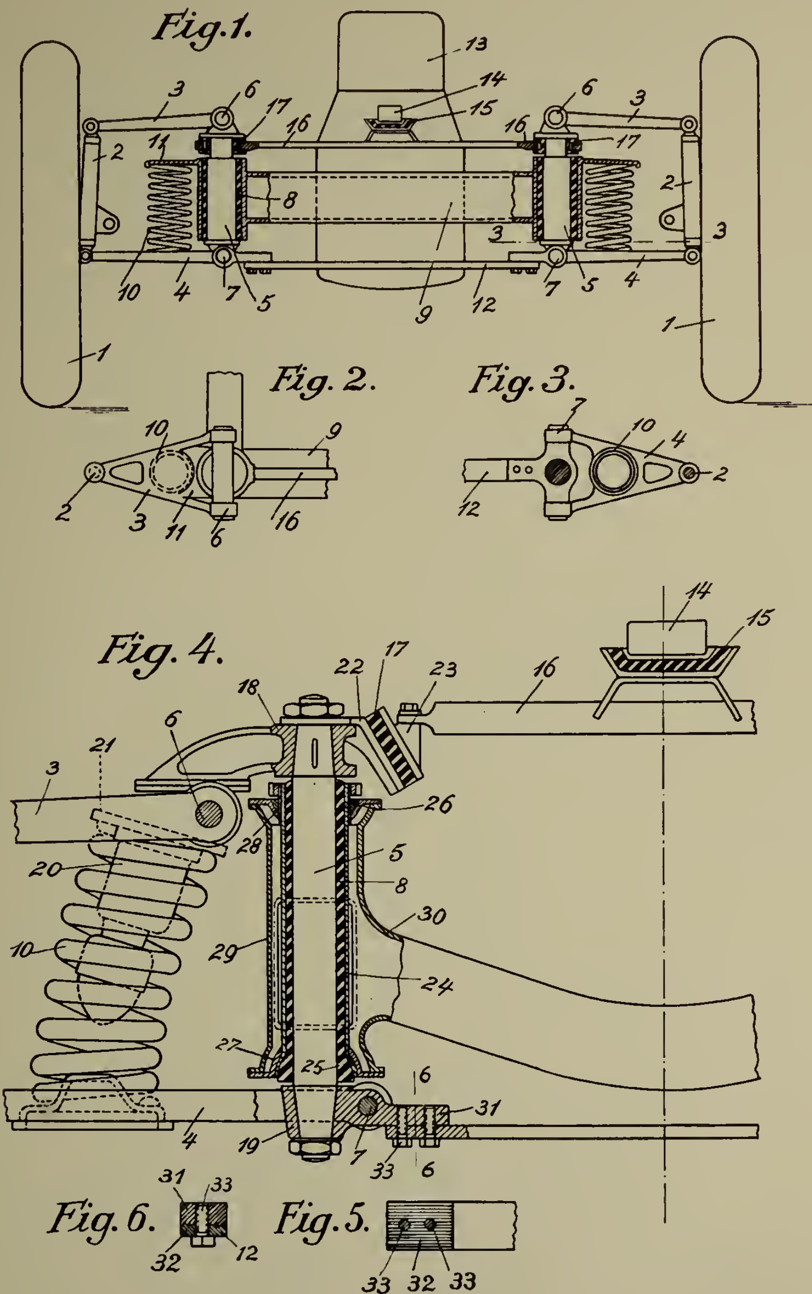

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INDEPENDENT WHEEL SUSPENSION CAPABLE OF YIELDING ABOUT A SUBSTANTIALLY VERTICAL AXIS

Siegfried Wulff, Stuttgart-Bad Cannstatt, Germany; vested in the Alien Property Custodian

Application filed March 1, 1941

The present invention relates to an independent wheel suspension capable of yielding about a substantially vertical axis. More particularly, the invention relates to an independent wheel suspension of a pair of wheels, especially wheels of a motor car in which the suspension of at least two wheels may somewhat yield relatively to the frame about a substantially vertical axis. The invention substantially consists in supporting the wheel suspensions against each other in the direction of rotation about the vertical axis. The supporting for instance may be effected by connecting together the supporting members of a pair of wheels, the supporting members being yieldably mounted about a substantially vertical axis of rotation and serving for mounting the wheel suspension members for instance two guide links arranged one above the other, the supporting members being rigidly connected to each other in the direction of rotation by a transverse member somewhat resilient in itself. The transverse member preferably is arranged substantially in the plane extending through the vertical axis of rotation of the two supporting members.

In a particular suitable construction one or more flat irons or spring leaves, arranged substantially horizontally and therefore under strain of bending acting around their edge ways, are provided for connecting to each other and sustaining the supporting members about their vertical axes of rotation.

Such a sustaining of the supporting members for the wheel suspension resiliently mounted at the vehicle, preferably at the frame, has the advantage that the frame will substantially be released of all forces acting in their horizontal plane upon the wheels and thereby upon the supporting members, and that viz. additional bending moments are obviated which occur at other points of the frame by sustaining the supporting pivots in a horizontal plane. Simultaneously the strains acting in a horizontal plane upon both wheel suspensions of a pair of wheels are rendered more uniform which is particularly favorable in case of steered wheels. The sustainment of the supporting members by one or several horizontally arranged spring leaves, moreover, results in the most simple sustainment and simultaneously in a particular low weight.

The invention, moreover, relates to a wheel suspension in which the supporting members for the wheel suspension, arranged at both sides of the longitudinal centre plane of the vehicle in a manner capable of elastically yielding in all directions, for instance substantially vertical supporting pivots each serving for mounting two guide links—or at least one of them—arranged one above the other, are supported against each other by two transverse members located one above the other. Thereby the two oppositely arranged supporting pivots are sustained with regard to each other in the manner of a parallelogram so that the forces occurring at the one supporting pivot simultaneously are absorbed by the other supporting pivot also. Thereby the supporting pivots as well as the frame are in an advantageous manner released from all strains occurring. The result of wheel pressures and shocks acting in a vertical direction upon the wheels is that the upper transverse member substantially is under strain of pressure and the lower transverse member substantially is under strain of tension. Preferably at least one of the transverse members simultaneously serves the purpose of sustaining the supporting members with regard to each other in horizontal direction. To this end e. g. one of the two transverse members, more particularly the lower transverse member, preferably is resilient in itself and rigidly coupled to the supporting members in the direction of rotation about a vertical axis, whereas the other, particularly the upper transverse member, may in the direction of rotation be linked or resiliently connected to the supporting members. The latter hereby simultaneously may serve for mounting the motor or other elements of the vehicle, e. g. of the differential.

In the accompanying drawing some embodiments of wheel suspensions according to the invention are shown by way of example.

In this drawing:

Fig. 1 is a diagrammatic view of a front axle according to the invention,

Fig. 2 shows a plan view of the means for guiding the left-hand wheel,

Fig. 3 is a plan view in section on the line A—B of Fig. 1 showing the means for guiding the right-hand wheel,

Fig. 4 shows a modification of a wheel suspension according to the invention on a larger scale and partially in section,

Fig. 5 is a plan view of the one end of a transverse member to be described later on, and

Fig. 6 is a section on the line C—D of Fig. 4.

In the construction shown in Fig. 1, the dirigible wheels **1** are carried by the wheel supports **2** which are connected by an upper link **3** and a lower link **4** as well as by joints **6** and **7** respectively to a vertical supporting pivot **5**.

The latter is mounted for instance by means of a rubber sleeve 8 in the frame 9 of the vehicle, the rubber sleeve allowing yielding of the supporting pivot mainly about its vertical axis, but in another direction also. To provide the wheel with springs, a coiled spring 10 for instance is provided which is not guided and the ends of which on the one hand bear against the lower link 4 and on the other hand against a bearing bracket 11 provided for example at the frame. To absorb the forces which tend to swing the wheel suspension about the axis of the supporting pivot 5, a flat iron or leaf spring which in a horizontal plane is somewhat resilient, is provided which connects the two supporting pivots 5 to each other at both sides of the longitudinal centre plane of the vehicle and preferably is arranged in the plane of these supporting pivots.

According to the invention the motor 13, moreover, is mounted upon a transverse member 16 for instance by a front bearing eye 14 and an interposed rubber buffer 15. The transverse member 16 connects the upper ends of the supporting pivots 5 to each other. Between the transverse member 16 and the supporting pivots 5 other rubber blocks 17 are provided which allow the required freedom of movement between the supporting pivots 5 and the motor. The transverse member 16 also preferably is somewhat elastic, more particularly capable of being elastically bent, whereby the mutual influencing of motor and wheel suspension is further reduced. To increase the resiliency the transverse member 16 may correspondingly be curved instead of being straight lined.

In the modification shown in Fig. 4, the elements also illustrated in Figs. 1–3 are designated with the reference characters used in Figs. 1–3 for such elements. In this case the two bearing members 18 and 19 are rigidly mounted upon the supporting pivots 5. The bearing member 18 serves for mounting the upper link 3 and the bearing member 19 for mounting the lower link 4. Moreover, a shock absorber 20 as well as an abutment 21 for the coiled spring 10 are arranged at the upper bearing member 18.

Fixed upon the upper end of the supporting pivot 5 is an angle iron 22 which by way of the interposed rubber block 17 is adherently connected to another metal member 23. Connected to the latter is the transverse member 16 which is capable of being elastically bent and which is carrying the motor. The arrangement hereby is such that the rubber block 17 of substantially rectangular cross section is between the connecting surfaces obliquely inclined downwardly towards the centre longitudinal plane of the vehicle. The forces due to the weight of the motor or other forces acting in a vertical direction, therefore, substantially are absorbed by the rubber blocks 17, whereas the rubber block 15 which for instance in a manner known per se also is arranged between metal elements and adherently connected to the latter allows substantially torsional vibrations of the motor about its longitudinal axis. Vertical vibrations are, moreover, absorbed by the transverse member 16 capable of being somewhat elastically bent. The resilient members 15, 16, 17 arranged between the motor 13 and the supporting pivots 5 are of sufficient resiliency in horizontal direction to allow the required yielding of the supporting pivot 5, particularly the yielding about the vertical axis of the pivot, and to prevent shocks occurring at the wheel suspension to be transferred to the motor which would be highly undesired.

To ensure a safe mounting of the supporting pivot 5 on the frame allowing an adjustment, the rubber sleeve 8 surrounding the supporting pivot is inserted in a metal sleeve 24 which by means of a ball-like end surface 25 and a ball-like intermediate ring 26 respectively bears against ball-like bearing caps or covers 27 and 28 which are mounted upon the open ends of a vertical frame sleeve 29. The latter in turn is arranged at the point of connection of a transverse beam 30 of the frame to a longitudinal beam of the frame which for instance may also be of tube- or box-like form. The frame sleeve 29 is welded to these frame beams to form a solid unit with same.

As may be seen from Fig. 4, the lower transverse member 12, formed as a flat iron or as a spring leaf and serving to sustain the two supporting pivots relatively to each other, is rigidly connected to the bearing member 19 for the lower guide link 4. Accordingly the bearing member 19 has an inwardly directed flange 31, the lower surface of which is at 32 toothed or chequered in the longitudinal direction of the transverse member 12. The end of the transverse member 12 also is correspondingly toothed or chequered. By screws 33 the transverse member 12 is strongly pressed against the flange 31 of the bearing member 19 so that by means of the toothed or chequered part 32 a rigid coupling between these two parts is obtained in the direction of rotation about the axis of the supporting pivot 5.

Yielding of the wheel suspension about the vertical axis of the supporting pivot 5, therefore, is possible only by a bending of the transverse member 12 in a horizontal plane, i. e. by bending forces acting around the edge way of the spring leaf 12.

Thereby the required relatively slight resiliency of the wheel suspension in a horizontal plane is ensured on the one hand and too large a resiliency in this plane, however, is prevented on the other hand.

By the use of a spring leaf for supporting, a particular low weight and a special large simplicity of the supporting members is obtained.

As the two supporting pivots 5 are directly sustained with regard to each other by means of the transverse member 12, the frame is released from the supporting forces of the wheel suspension in horizontal plane.

The arrangement of the lower transverse member 12 and the upper transverse member 16 effects supporting of the two oppositely arranged elastically arranged supporting pivots 5 in the manner of a parallelogram so that under the action of the wheel pressure the upper transverse member 16 is under strain of pressure, whereas the lower transverse member 12 is under strain of tension.

If wanted the supporting pivots may be sustained with regard to each other about vertical axes by separate supporting arms for each of the supporting pivots for instance in such a manner that the bearing member 19 of the left-hand supporting pivot bears against the bearing member 19 of the right-hand supporting pivot and vice versa, rubber being interposed between the bearing member and the corresponding connecting member (12). Instead of a spring leaf capable of being bent around its edge way, any other suitable resilient device, for instance a sufficiently stiff leaf spring with vertically arranged spring

leaves, or for instance a torsional spring mounted on the frame may be used which by means of suitably interconnected lever arms are actuated by the supporting pivots resiliently mounted about a vertical axis of rotation in such a manner that a rotation of the one supporting pivot tends to effect rotation of the other supporting pivot in opposite direction.

It is understood that the wheel suspension members also may be mounted e. g. upon an U-shaped forging instead of on the supporting pivots above described.

Also the rigidity against torsion of the connection between elastic member and support member may be secured in another manner, e. g. the lower transverse member **12** may be a one piece forging with the bearing members **19**; or there may be arms, forged as one piece with members **19** and yieldably, as by interposed rubber, supported by the frame.

SIEGFRIED WULFF.

PUBLISHED

MAY 25, 1943.

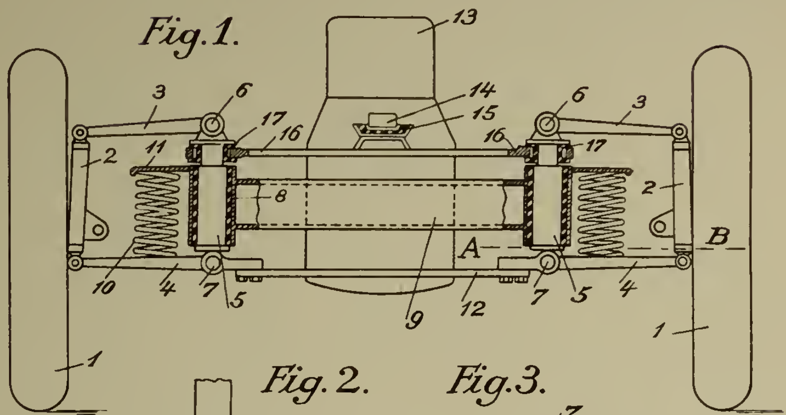
BY A. P. C.

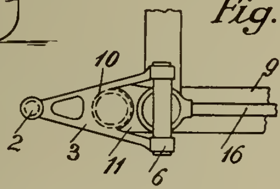
S. WULFF

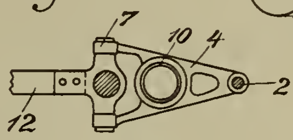
INDEPENDENT WHEEL SUSPENSION CAPABLE OF YIELDING ABOUT A SUBSTANTIALLY VERTICAL AXIS

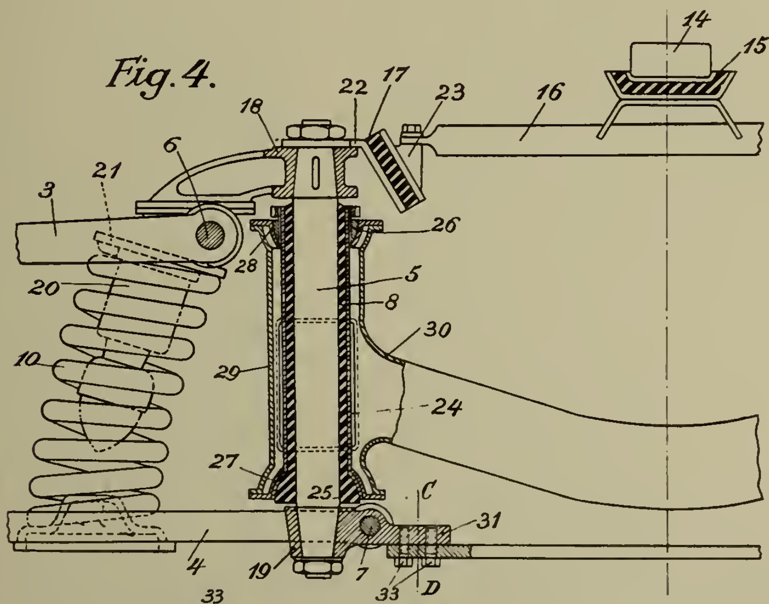
Filed March 1, 1941

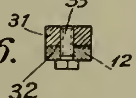
Serial No. 381,314

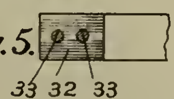












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Published May 25, 1943 Serial No. 382,106

ALIEN PROPERTY CUSTODIAN

PLANTS FOR DISTRIBUTING AIR UNDER PRESSURE AND IN CONSTITUTING PARTS THEREOF

Charles Raymond Waseige, Rueil-Malmaison, France; vested in the Alien Property Custodian

Application filed March 6, 1941

My invention relates to plants for supplying air under pressure, more particularly for use on board of aircraft, when air under various pressures has to be supplied to the various apparatus needing it, some of which, such as pneumatic lifting jacks, pneumatic starters, etc., require air under a relatively high pressure, for instance of the order of 30 hectopiezes, and other of which, such as automatic steering apparatus, require air under a much lower pressure, for instance of the order of 5 hectopiezes.

It has already been proposed to connect the distributing circuits of such plants with a common compressed air reservoir filled from a generator or a bank of generators with air under the highest pressure and connected by means of pressure reducing valves with the circuit or circuits at lower pressure. This arrangement has the drawback that it requires one or several generators of such substantial power as to be able to fulfill simultaneously the needs of various circuits which may have to be used simultaneously.

On the other hand, it is usual to interpose between the permanently driven generator or generators and the high pressure reservoir of an air distributing plant a control valve, or regulator, arranged to automatically connect the delivery of said generator or generators with a release outlet, usually leading to the open air, when the pressure obtaining in the reservoir attains a maximum limit value and to again connect it with said reservoir when the pressure therein becomes lower than a predetermined minimum value, the latter being however higher than the air pressure in the low pressure circuit or circuits.

One object of the present invention is to provide an air distributing plant of the aforesaid kind comprising at least such a control valve between the generator or generators and the high pressure reservoir and arranged so as to require only one or several generators the power of which is substantially smaller than that of the heretofore known plants, and permitting to supply in an entirely automatic manner air under different pressures to at least two circuits, by means of a rational fitting up of the utilization of the compressed air produced.

A plant constructed in accordance with this invention is essentially characterized in that the release of said control valve is connected with one or all of the low pressure circuits, comprising preferably a relief valve.

Under these conditions, as soon as the maximum pressure obtains in the high pressure reservoir, the delivery of the generator or generators feeds through said control valve the low pressure circuit, which usually also comprises a reservoir, and said high pressure is again connected with the generator or generators, as soon as the pressure therein falls under the lower limit.

The air generator or generators are thus rationally utilized in a more continuous manner than in the usual plants.

The plant comprises advantageously besides the aforesaid control and relief valves a pressure reducing valve branched between the delivery circuit of the generator or generators and the low pressure circuit, so as to secure the feeding of said circuit during the rise of pressure in the high pressure reservoir.

The relief valve of the low pressure circuit may be arranged in parallel or in series with the conduit feeding the low pressure or other reservoir.

In the latter case, it is advantageously combined with an automatic distributing valve connecting the release passage of the control valve with the open air while at the same time disconnecting the reducing valve if it is desired that the low pressure circuit will not be supplied.

According to another embodiment of the invention, the reducing valve and the relief are embodied into a single apparatus, called automatic release reducing valve, connected both with the high pressure circuit and the low pressure circuit, which is itself connected with the release of the aforesaid control valve.

This automatic discharge reducing valve may advantageously comprise a chamber which is connected with the low pressure circuit and a wall of which is movable and urged against the pressure in this circuit by a resilient member, said movable wall controlling two combined valves through which said chamber is respectively connected with the high pressure air inlet passage and a release passage, the whole being so balanced that this wall only opens the first valve when the pressure in said chamber becomes lower than a predetermined value and only opens the second valve after the closure of the first one and when the pressure in the chamber exceeds a second predetermined value substantially higher than the first value.

A single resilient member thus assures the control of the low pressure and avoid any overlapping in the operation of the high pressure air inlet and release valves, which might otherwise cause a continuous release of air.

The simplification thus effected may further be increased, according to another feature of the

invention, by combining the automatic release reducer and the regulator into a single controlling and reducing apparatus.

This apparatus, all the features of which may be adjusted on the proofing bench, embodies in itself all the essential parts of the plant supplying the reservoirs, so that no adjustment is necessary after the assembly.

The present invention also comprises in its ambit, as now industrial products, the elements of the new plant, individually considered, which may even be used in a plant differing from that described, more particularly the distributing valve, the automatic release reducer and the regulator-reducer.

Other features and advantages of the invention will be apparent from the following description with reference to the annexed drawings, only given as an example, in which:

Fig. 1 shows a plant constructed in accordance with the invention;

Fig. 2 shows a modification in which use is made of an automatic release reducing valve;

Fig. 3 is a schematic view of a combined controlling and reducing valve.

In order to simplify the description, the usual accessories of the plant, such as decanters, filters, diaphragms, cutting-out valves or cocks, etc., have not been shown in Figs. 1 and 2 and it is assumed that the plant comprises only two distributing circuits.

In accordance with the embodiment shown in Fig. 1, the plant comprises for feeding with air a high pressure reservoir **1** and a low pressure reservoir **2**, and air producer or generator **3** for poducing air under high pressure, a control valve **4** comprising inlet, outlet and release passages **6**, **7** and **8**, a pressure reducing valve **10** with inlet and outlet passages **11** and **12** and a distributing valve **14** having two inlet passages **15** and **16**, one outlet passage **17** and one release passage **18**. A conduit **19** connects the discharge of the generator **3** with the inlet passage **6** of control valve **4** and the inlet passage **11** of reducing valve **10**. The reservoirs **1** and **2** are connected through conduits **20** and **21** with the outlet passages **7** and **17** of control valve **4** and distributing valve **14**, respectively. Conduits **22** and **23** connect the inlet passages **15** and **16** of distributing valve **14** with the release passage **8** of control valve **4** and the outlet passage **12** of reducing valve **10**.

The control valve **4**, of a known type, comprises a chamber **24** with which the inlet passage **6** communicates through a non-return valve **25** and into which opens the outlet passage **7**. A duct **26** opening into the passage **6** beyond the non return valve **25** leads to the release passage **8**. Inserted in this duct **26** is a valve **28** serving to close it normally and connected by a stem to a lever **30** pivoting, at one end, on a fixed pin **31** and, at the other end, on a movable system **32** serving as a piston and urged by the antagonist actions of a calibrated spring and the pressure in the chamber **24**. A wedge-like cam **35** rigidly connected to the lever **30** so as to rotate together with the latter round the pin **31** co-operates with a follower roller pressed against the periphery of said cam by a spring **37**.

The pressure reducing valve **10**, which is also of a known type, comprises a chamber **40** into which opens the low pressure air outlet passage **12**. Said chamber forms one end of a cylinder the piston **42** of which carries a sealing cup **43** and is subjected to the aforesaid low pressure of air acting against the action of a spring **44** retained by a cap **45** screwed upon the housing of said valve.

The inlet passage **11** for air under high pressure communicates with the chamber **40** through a valve **47** the seat for which is carried by a part **48** secured to the housing **10**. Said valve **47** carries a stem **50** held in engagement with a central projection **51** on piston **42** by a spring **53**. Said spring **53** is seated at one end, in a head **54** secured to the housing **10** and, at the other end, in a sliding sleeve **55** containing the valve proper **47**.

Finally, the distributing valve **14** comprises a chamber **60** into which open the inlet and outlet passages **15**, **17**. This chamber **60** is connected through valves **63**, **64** with the release passage **18**, usually opening into the atmosphere, and the air inlet passage **16**, respectively. The seats of these two valves are integral with the valve body. Valve **63** is urged towards its seat, against the pressure of air in chamber **60**, by a suitably calibrated spring **66** engaging with a nipple-like head **67** provided with the passage **18**. Valve **64** is arranged in a similar way. Both valves are provided with stems projecting through the seats thereof and co-operating with a cam **70** which is rigidly secured upon a shaft **71** and so shaped that it opens either the one or the other of the valves according to whether the position it assumes is that shown in the drawing (valve **64** being then opened) or the symmetrical position. A hand lever (not shown) secured to the shaft **71** permits to control the rotation of the cam **70**.

The operation is as follows:

Air delivered by the generator **3** into the conduit **19** is admitted throught the latter into the inlet passages **6** and **11** of the control valve and the reducing valve.

As long as reservoir **1** is not under full pressure:

1. The valve **28** provided inside the control valve is closed and air under pressure passing through the non-return valve **25** leaves the control valve through the outlet **7** and is led to the said reservoir **1** by the conduit **20**.

2. The air admitted by the conduit **11** may or not enter into the chamber **40** through the valve **47** which is opened or closed according as whether or not the pressure in this chamber is higher than the pressure value that would exert upon the piston **42** a thrust counterbalancing the force exerted on the other side of said piston by the spring **44**. This pressure value, substantially lower than the pressure in the conduit **11**, is that of the air leaving the reducing valve by the conduit **23** leading to the inlet **16** of distributing valve **14**. The position of the parts of the latter valve is as shown in Fig. 1; hence compressed air flows out of said distributing valve through outlet **17** and is led by conduit **21** to reservoir **2**.

As soon as the pressure obtaining in the reservoir **1** attains its predetermined maximum limit value, the force exerted by the air upon piston **32** of control valve **4** counter-balances the antagonist elastic forces and causes said piston to slide towards the right as shown in Fig. 1, the cam **35** acting as a latch. The valve **28** is then opened and the passage **6** is connected with the release **8**, the non-return valve **25** disconnecting said passage from chamber **24** and reservoir **1**. The air delivered by the blower is then transferred by conduit **22** to the distributing valve **14** and thence, through conduit **21**, to reservoir **2**. The relief valve **63** prevents the pressure in con-

duits 21 and 22 from exceeding the pressure value corresponding to the calibration of its spring 66, which is substantially lower than the pressure of air supplied to reservoir 1 and slightly higher than the pressure of air supplied by the reducing valve 10. As this pressure value is transmitted by the conduit 23 to the chamber 40 of said reducing valve, the valve 47 is held upon its seat so that the reducing valve will not operate.

As soon as the pressure in reservoir 1 becomes lower than a predetermined limit, the spring 33 brings the piston 32 back to its starting position against the pressure of air in chamber 24, the valve 8 is closed and the cycle is repeated.

When it is desired to put the reservoir 2 out of circuit, one has only to rotate of 180°, by means of the hand lever secured to the shaft 71, the cam 70 of the distributing valve 14. This closes the valve member 64, thus isolating the reducing valve 10, and opens the relief valve 63. The release passage 8 of control valve 4 is then permanently connected with the open air.

In accordance with the modification shown in Fig. 2, a reducing valve with automatic release 80 comprising an inlet passage 11, an outlet passage 12 and a release passage 81, usually connected with the open air, is provided instead of the reducing and distributing valves according to the embodiment previously described. The control valve 4, of the same type as that already described, to the inlet passage of which the conduit 19 delivering air from the generator is connected, has its outlet passage leading through a conduit 20 to the high pressure reservoir 1 and to the inlet passage 11 of automatic release pressure reducing valve 80. The release passage of the control valve 4 is connected by a conduit 22—23 with the outlet passage 12 of reducing valve 80 and the low pressure reservoir 2.

The reducing valve comprises a chamber 40 into which opens the outlet passage 12. One wall of this chamber 40 is formed of a piston 42 the periphery of which is connected by an undulated sleeve-like diaphragm 83 to an outer shoulder 84 of the side wall 85 of said chamber 40. Acting on the piston 42 against the pressure exerted thereon by the air contained in chamber 40 is a spring 44 urging same towards a seat 86 formed at the end of the side wall 85. The spring engages on the one hand with the outer side of piston 42 and on the other hand with the bottom of a sleeve cap screwed on the body of valve 80. The outer side of piston 42 is subjected to the pressure of air in the release passage 81 with which the part of the body which contains it communicates through a port 88.

The inlet passage 11 is provided in a separated nipple 90 tightly sealing the bottom of chamber 40. As an extension of the passage 11 is formed in said nipple 90 a cylindrical lodgment 91 coaxial with the piston 42. A valve member 47 is slidably mounted in this lodgment 91 which encloses a spring 53 urging said member towards its seat 93 provided on a part 94 screwed onto the end of nipple 90 projecting into chamber 40. The valve member 47 is extended by a central stem 95 that projects through the part 94 and engages with another valve member 98 co-operating with an annular seat 99 provided on piston 42. Openings 100 are provided through said piston 42 inside the seat 99. The valve member 98 carries an axial stem extension 102 slidably mounted in a guide provided on piston 42, the end of said stem 102 being arranged opposite to a stop 103 formed by the end of a screw 104 mounted in the bottom of cap 45. Said screw 104 is adjusted so that the stem 102 engages therewith as the valve member 47 is applied upon its seat 93. A protecting hood 107 surrounds the whole device.

The operation is as follows:

During the rise of pressure in reservoir 1, compressed air supplied to this reservoir is simultaneously admitted into the inlet passage 11 of reducing valve 80. The latter then operates as an usual pressure reducing valve, i. e. the valve member 47 is held in its opening position by the piston 42 as long as the pressure in chamber 40 connecting with reservoir 2 remains lower than the calibrated pressure of the spring 53. As soon as this pressure is attained, however, the valve member 47 will be applied upon its seat 93 by said spring 53, after which the same process will be effected as the air pressure becomes lower, so that the reservoir 2 is supplied with air at the low pressure required.

When the pressure of air in the reservoir 1 reaches the maximum limit value of control valve 4, the latter disconnects the conduit 20 and connects the compressed air inlet conduit 19 and the release conduit 22 supplying the reservoir 2 by means of the conduit 23, one end of which opens into the chamber 40. When the pressure of air in this chamber 40 rises, the piston 42 is shifted against the counteraction of spring 44, so that beyond a fixed limit, as the stem 102 strikes against the end 103 of the screw 104, the holes 100 are uncovered by the valve member 98 and connect the chamber 40 with the release 81. There is thus obtained a relief valve preventing any excess of pressure in the conduit 23 on which it is branched.

The provision of a single spring 44 prevents any overlapping between the admission and delivery of air into and from the chamber 40, which would otherwise allow a continuous release of air.

In order to still more simplify the assembling by reducing the connections, there is shown in Fig. 3 an example of a controlling-reducing valve assembly 109 arranged to be used instead of the separated control and reducing valves according to the example shown in Fig. 2. This new apparatus comprises four passage couplings, namely an inlet passage 6 arranged to be connected with the generator, two outlet passages 7 and 12 arranged to be connected with the high and low pressure reservoirs, respectively, and a release passage 81, usually connected with the open air.

The inlet passage 6 opens into a chamber 110 connecting through a non-return valve 25 with a chamber 111 extending the whole length of the housing 109 and into which opens the passage 7 connected with the high pressure reservoir. Between the chambers 110 and 111 is provided an intermediate chamber 112 into which opens the passage 12 connected with the low pressure circuit. The connection between the chambers 110 and 112 is secured through the valve member 28 which is a part of a control valve and forms the release valve of the same. While this control valve may be of the same type as that shown in Fig. 1, it has been assumed as an example as being of a different construction.

According to this embodiment, the valve 28 is not balanced and it carries a stem 114 engaging with a wall 116 formed as a plunger piston which moves in the direction of the shifting motion of the valve 28 and a side of which is secured in an airtight manner to a bellows-like resilient sleeve

118 the other end of which is connected with the periphery of a hole 120 opening into the chamber 111. The piston 116 is provided with a flange on which is resting a spring 122 urging said piston in the direction of the closing movement of valve 28.

The chambers 111 and 112 are connected together through a valve 47 which is the inlet valve of a reducing valve of the automatic release type shown in Fig. 2 and is shown only in a schematic manner in Fig. 3. The parts of this reducing valve are contained in a chamber 125 into which opens the release passage 81 and in which is slidably mounted a piston 42 provided with the seat of a valve 98 combined with the valve 47 to which it is connected by a stem 95. A light spring 53 tends to move both valves in the direction of their seats. That side of piston 42 opposite the two valve members 98, 47 is subjected to the pressure obtaining in chamber 112, which is transmitted to it through the hole 127 surrounding the stem 95, air-tightness being secured by a resilient sleeve-like diaphragm 83 connecting the periphery of this piston to a shoulder provided around the hole 127. The piston 42 is subjected to the pressure of air in chamber 112 in counteraction to a spring 44 resting upon the bottom of chamber 125.

The operation is as follows:

During the rise of pressure in the high pressure reservoir and as long as the air pressure therein has not attained the maximum limit value, the valve 28 is closed and air admitted into the apparatus by the passage 6 enters into the chamber 111 through the non-return valve 25. A portion of this air is directed towards the reservoir through the passage 7 and another portion is reduced in pressure while passing through the chamber 112 and conducted towards the low pressure reservoir through the passage 12. This reduction of pressure is effected exactly as described relatively to the previous examples, the opening and the closing of valve 47 being controlled by the piston 42.

As soon as the pressure in the reservoir and therefore in the chamber 111 attains its upper limit value, the thrust exerted by the air pressure against the piston 116 counterbalances the forces exerted by spring 122 on said piston and by the pressure of the air in chamber 110 on the valve member 28. The latter opens suddenly and the forces exerted on both sides thereof are then equalized. As the chambers 110 and 112 are now connected by the valve 28, there occurs a substantial drop of pressure in the first chamber and rise of pressure in the second chamber supplying the low pressure circuit. Owing to this rise of pressure the piston 42 is shifted against the action of the spring 44, the valve 47 is closed and the valve 12 acts as a relief valve as described in the previous embodiment. When the pressure in the chamber 111 connected with the high pressure reservoir becomes sufficiently low so that it may be counter-balanced by the spring 122, the valve 28 is returned upon its seat and the cycle is repeated.

The invention is, of course, in nowise limited to the embodiments shown and described as examples, and it is particularly obvious that, without departing from the ambit of said invention, there may be introduced into the various circuits the usual accessories such as diaphragms, valves, cuting-out, blow-off or coupling devices, filters, cleaners and the like.

CHARLES RAYMOND WASEIGE.

PUBLISHED
MAY 25, 1943.
BY A. P. C.

C. R. WASEIGE
PLANTS FOR DISTRIBUTING AIR UNDER PRESSURE AND IN CONSTITUTING PARTS THEREOF
Filed March 6, 1941

Serial No. 382,106
2 Sheets-Sheet 1

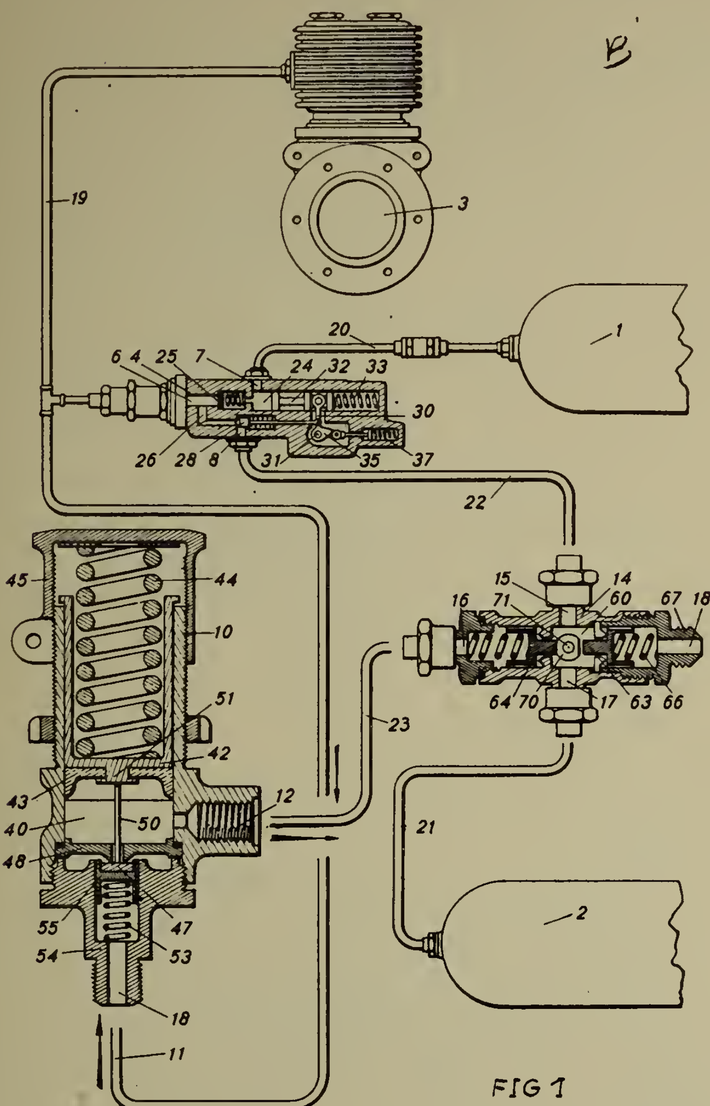

FIG 1

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MAY 25, 1943.

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PLANTS FOR DISTRIBUTING AIR UNDER PRESSURE AND IN CONSTITUTING PARTS THEREOF

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Serial No. 382,106

2 Sheets-Sheet 2

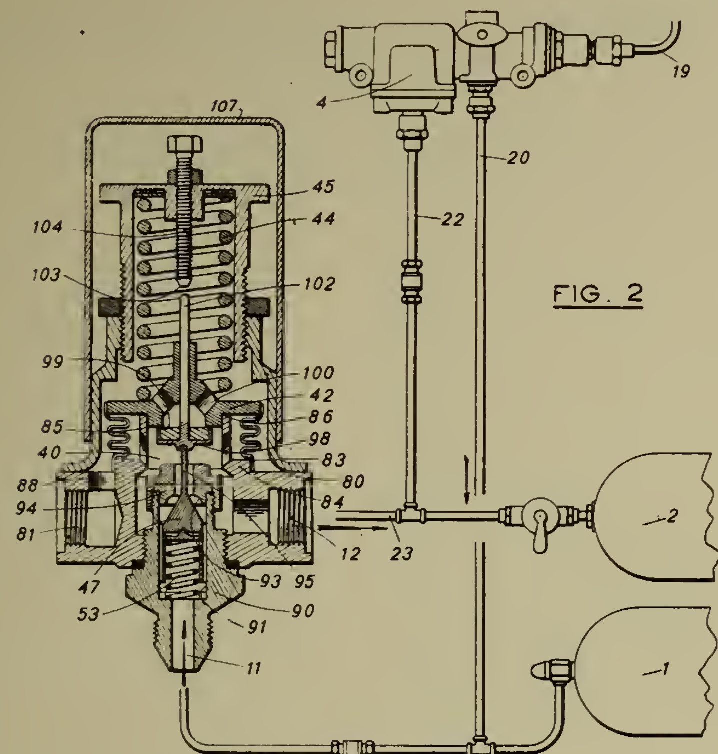

FIG. 2

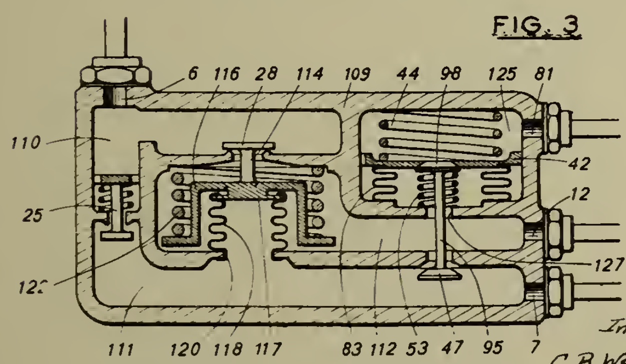

FIG. 3

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Published May 25, 1943

Serial No. 382,394

ALIEN PROPERTY CUSTODIAN

LUBRICANTS

Mathias Pier, Heidelberg, and Friedrich Christmann, Ludwigshafen - on - Rhine, Germany; vested in the Alien Property Custodian

No Drawing. Application filed March 8, 1941

The present invention relates to improved lubricants, more particularly lubricating oils.

We have found that the properties of lubricants, and especially of mineral lubricating oils, are much improved by an addition of high molecular weight polymerization products obtained by polymerizing compounds having a polymerizable double linkage which, when polymerized by themselves with the aid of acid-reacting inorganic halides or substances having large surfaces, yield products of high molecular weight, i. e. of a molecular weight above 1000, and which preferably contain an aromatic group, in admixture with cracking or dehydrogenation products of hydrocarbons or the hydrocarbons obtained in the synthesis of benzine from carbon monoxide and hydrogen, if they contain unsaturated constituents, the polymerization being effected with the aid of acid-reacting halides or substances having large surfaces.

As compounds to be used in the production of the said polymerization products, which have a polymerizable double linkage and which when polymerized alone by means of acid-reacting inorganic halides or substances having large surfaces yield high molecular weight products, use is preferably made of styrene, alkylstyrenes, cumarone or indene, either alone or in admixture with other compounds capable of yielding high molecular weight products, as for example vinyl ethers, as for example vinyl ethyl, vinyl isobutyl or vinyl oleyl ether, isobutylene, monovinylacetylene or divinylacetylene; the latter group of substances may also be used alone, though generally with less good results.

Suitable cracking or dehydrogenation products of hydrocarbons are in particular those which are obtained from hydrocarbons rich in hydrogen which preferably contain more than 13.5 grams in particular more than 15 grams, of hydrogen for each 100 grams of carbon, or from paraffin base mineral oils or their fractions. Cracking or dehydrogenation products of the substances obtainable in the synthesis of benzine from carbon monoxide and hydrogen with or without pressure or the said substances themselves if they contain unsaturated constituents are also suitable. The products obtainable by cracking the said substances above 350° C., if desired in the presence of catalysts, as for example alumina or bleaching earths, which may also be treated with acids, as for instance hydrochloric acid, or in particular by cracking at temperatures of from 450° to 800° C. are most suitable. In the latter case, the cracking products contain large amounts of constituents unsaturated more than once.

The dehydrogenation products may also be obtained in known manner, as for example by leading the initial materials through hot tubes or over known dehydrogenation catalysts, by treatment of saturated hydrocarbons with halogen and then splitting off hydrogen halide or by treatment with oxyyen or sulphur, if desired in the presence of bleaching earths, boric acid or oxalic acid.

The production of the polymerization products is preferably carried out with the aid of inorganic acid-reacting halides, as examples of which there may be mentioned aluminum chloride, iron chloride, zinc chloride, titanium chloride and in particular boron fluoride and also its addition compounds with alcohols, ethers, acids or water. The production of the polymerization products may also be effected by means of substances having large surfaces, among which in particular those of an acid nature, as for example silica gel or the bleaching earths known under the names "Terrana," "Florida earths" and "Fuller's earth" are suitable. Their action is frequently enhanced by additions of acids, as for instance boric or phosphoric acid, or acid salts.

The polymerization of the mixtures of the said substances may be carried out at ordinary, increased or reduced temperature, as for example below 0° C. or better at from 10° to 70° below zero C. or still lower.

Solvents may also be used during the polymerization, as for example hydrocarbons, such as benzene or benzine, or haligen hydrocarbons, such as carbon tetrachloride, chloroform, ethylene chloride, or also dichlordiethylether or esters or mixtures of such solvents.

The polymerization products obtained are soluble in mineral oils and are valuable agents for improving the viscosity and viscosity index thereof. Whereas substances which improve the viscosity of oils are frequently very sensitive to temperature and lose their action at about 300° C., the said polymerization products are stable to temperature and retain their improving action on lubricating oils even when the latter are heated to high temperatures for long periods. The polymerization products are also very resistant to high pressures, such as occur for example in modern gears or bearings, and form very stable lubricant films. They may be added not only to lubricating oils, but are also suitable as additions to gear oils and greases.

The following examples will further illustrate

how this invention may be carried out in practice but the invention is not restricted to these examples. The parts are by weight.

Example 1

Gaseous boron fluoride is led at ordinary temperature into a mixture of 70 parts of styrene and 130 parts of a liquid hydrocarbon mixture containing unsaturated hydrocarbons which has been obtained by cracking paraffin wax at 500° C. The mixture thus becomes heated to about 60° C. The mixture is kept at the said temperature for 10 hours. The polymerization product obtained is heated to 250° C. to remove boron fluoride and then distilled in vacuo. As a distillate there are obtained 10 parts of middle oil and 50 parts of spindle oil. There remain 126 parts of residue in the form of a tough, plastic mass having a Conradson test of 0.16 per cent. This mass is very suitable as an addition to lubricating oil. For example, an addition of 5 per cent thereof to a machine oil having a viscosity of 6.5° Engler at 50° C. and a viscosity index of 5 increases the viscosity of the oil to 8.6° Engler at 50° C. and the viscosity index to 49.

Example 2

A mixture of 50 parts of isobutylene, 50 parts of styrene and 55 parts of a liquid hydrocarbon product obtained by cracking paraffin wax at 500° C. is cooled down to 5° below zero C. and polymerized by leading in gaseous boron fluoride. The temperature rises slowly to 50° C. during the polymerization. A highly viscous oil having a viscosity of 80° Engler at 100° C. is thus obtained with a yield of about 92 per cent. It is suitable for improving the viscosity of hydrocarbon oils, especially lubricating oils, and this property is not destroyed even when heating the oils containing it at about 300° C. For example, by an addition of 5 per cent of the product to a lubricating oil, the viscosity index of the latter is increased from 50 to 80.

Example 3

Boron fluoride is passed at ordinary room temperature into a mixture of 45 parts of styrene and 55 parts of a normally liquid hydrocarbon product obtained by cracking paraffin wax and containing between 60 and 70 per cent of olefines. The temperature of the mass is slowly increased by heating to 50° C. where it is maintained for five hours, whereupon the mass is heated for a further five hours at 65° C. Thereafter the mass is heated to 200° C. in order to drive off the boron fluoride and then subjected to distillation in vacuo whereby as first runnings 5 per cent (calculated with reference to the initial mixture of hydrocarbons) of a middle oil boiling from 200° to 300° C. and 35 per cent of a spindle oil boiling from 300° to about 380° C. are obtained. The distillation residue is a highly viscous mass which when added in an amount of 3 per cent to a machine oil having a viscosity of 6° E. to 50° C. yields an oil having a viscosity of 8.3° E. at 50° C.

Similar results are obtained when employing, instead of a cracking product from paraffin wax, a liquid reduction product of carbon monoxide which contains substantial amounts of olefines or which has been rendered unsaturated by dehydrogenation or cracking, or also a dehydrogenation product of a paraffinic benzine.

Example 4

40 parts of styrene, 30 parts of isobutylene and 30 parts of a liquid hydrocarbon product obtained by cracking paraffin wax and containing 70 per cent of olefines are dissolved in an equal amount of ethylene chloride whereupon about 3 per cent by weight of boron fluoride is passed in while cooling with ice. The temperature of the mass slowly increases to 60° C. In order to remove the boron fluoride and the ethylene chloride the mass is heated to 200° C. and thereafter subjected to distillation in order to distill off small amounts of oils with medium boiling point range up to about 380° C. The distillation residue is a highly viscous product which when added in an amount of 5 per cent to a machine oil having a viscosity of 5° E. at 50° C. increases the viscosity of the oil to 7.8° E. at 50° C.

This application is a continuation in part of our copending application for Patent Ser. No. 217,280, filed July 2, 1938.

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ALIEN PROPERTY CUSTODIAN

PROCESS FOR PRODUCING CATALYSTS

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No Drawing. Application filed March 10, 1941

As known, porous carrier substances impregnated with zinc- and cadmium salts of organic acids, above all those with an active surface like active carbon, silicagel and the like are catalysts for various chemical reactions especially for the thermal production of organic vinyl esters of acetylene and the corresponding organic acids, but they may also be used f. i. for the thermal production of vinyl chloride from acetylene and hydrogen chloride, whereby the catalyst is formed in the course of the process. Such catalysts were produced hitherto in such a way that an aqueous solution of the zinc or cadmium salt was absorbed by active carbon or if necessary by silicagel, pumice stone or the like whereby generally in order to concentrate the metal salt in the carrier an amount of the solution was added in excess and hereafter the water was extensively removed by drying. In order to get a catalyst having little water, a long drying in the vacuum was necessary by which in consequence of the unavoidable escaping of acid vapors the material of the vacuum dryer was corroded and basic zinc or cadmium salts were formed, the equal regeneration of which in the highest active form is very difficult because of the influence of the acid on the catalyst being employed. Besides, such a drying under technical conditions does not yield only an approximately anhydrous catalyst. Consequently, at the beginning of producing vinyl acetate e. g. important amounts of acetic acid-water mixtures are formed, corroding the walls of the reaction room and of the accessory apparatus, causing a partly decomposition of the formed vinyl acetate into acid and acetaldehyde and making difficult the isolation of the vinyl acetate from the raw reaction product.

It has now been found that catalysts, absolutely free from water, may be easily produced whereby the above mentioned process of drying the catalyst which is connected with difficulties in materials and an expense of time and costs is not necessary.

The new method of producing consists in impregnating the carrier substances with a melting consisting of a mixture of the organic zinc- or cadmium salts to be employed with the corresponding salt of a basic nitrogen compound, whereby, if necessary, an excess of the free basic nitrogen compound may be present. Generally, anhydrous meltings of this kind will be employed; a melting not absolutely free from water however, yields—according to the points of view demonstrated in the introduction—a still much more suitable catalyst than that one obtained by impregnating the carrier with aqueous solutions of zinc- and cadmium salts. If using as starting material zinc- or cadmium oxides and carbon acids which contain no or small amounts of water, the formed or given amount of water may be easily bound partly or wholly by adding corresponding quantities of acid anhydride.

The impregnation of the porous carrier substances, like f. i. active carbon, with such meltings proceeds surprisingly well. The melting is simply mixed with the active carbon by stirring resp. by mixing thru, whereby it is best, if the melting is added to the active carbon which is moved in a rotating drum heated if necessary. Then the catalyst may be applied directly e. g. for producing vinyl acetate.

It is surprising that the impregnation in a compact form yields catalysts which—containing the same amount of zinc- or cadmium salts—are as active as those produced in a troublesome way with aqueous solutions. Further it is surprising that such high concentrations of the zinc- and cadmium salts can be obtained with the salts of basic nitrogen compounds at temperatures lying below those for the dissociation or splitting off of ketone of the metallic salts as the following examples show. It is further surprising that the nitrogen compounds brought into the catalyst do not injure the activity of the catalyst. Hereby also the possibility is given to produce catalysts containing specially large amounts of zinc- or cadmium salt whereby they are especially capable.

Example 1

Basic ammonium acetate, produced by leading ammoniac into glacial acetic acid until saturation at 100° solves—heated up to 140°—the 1,8 fold of its weight of zinc acetate. Well suited additions to the catalysts are e. g. the following:

(a) 12 kg of glacial acetic acid are saturated with ammoniac at 100°. At about 140° 18,6 kg of glacial actic acid and 12,4 kg of zinc oxide are gradually added at the same time and solved in the melting.

(b) 12 kg of glacial acetic acid are saturated with ammoniac at 100°. At about 140° 10,6 kg of zinc oxide and a mixture of 15,0 kg of glacial acetic acid and 4,5 kg of acetic anhydride are gradually added at the same time and solved in the melting.

(c) 12 kg of glacial acetic acid are saturated with ammoniac at 100°. At about 140° 12,4 kg of zinc oxide and 15,6 kg of acetic anhydride are

gradually added at the same time and solved in the melting.

In all cases homogeneous meltings are formed, being sufficient thin liquid as to be absorbed equally by 30–35 kg of active carbon and thereby yielding a catalyst directly to be applied for producing vinyl acetate being at least equivalent to a catalyst produced with aqueous solutions. Not mentioning that the concentration and drying process was omitted, the catalyst yielded according to (*a*) at the beginning of producing vinyl acetate much less aldehyde and aqueous reaction product than the catalyst produced with aqueous solutions dried as far as possible in a troublesome way. In the production of the catalyst according to (*b*) the forming of aldehydes and the contents of water still more declined; in the catalyst obtained according to (c) these undesired secondary reaction products were completely lacking.

Example 2

A solution of 60 g of urea in 120 g of glacial acetic acid solved at 100° 60 g of anhydrous zinc acetate, at 130–150° further 180 g more, at 160° once more 60 g. On the whole the fivefold of the weight of the urea was solved, resp. a 62,6%ic solution of zinc acetate was obtained. This too was easily absorbed by the active carbon and yielded a special active catalyst.

Example 3

The neutralization product of 79 g of pyridine and 30 g of glacial acetic acid solves at 80° 79 g of unhydrous zinc acetate, at 125° once more the same quantity and at 150° further 79 g, wholly 237 g that is the threefold quantity of the applied pyridine.

Example 4

A solution of 35 g of hexamethylen tetramine in 60 g of glacial acetic acid solves till 150° 70 g of anhydrous zinc acetate.

Example 5

30 g of glacial acetic acid were neutralized with 50,5 g of triethanol amine. At 120° this melting solved 50,5 of anhydrous zinc acetate, at 140° once more 50,5 were nearly completely solved.

Example 6

The neutralization product of 93 g of aniline and 60 g of glacial acetic acid solves at 140° about the same weight of anhydrous zinc acetate.

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ALIEN PROPERTY CUSTODIAN

GASTIGHT HOUSING FOR FILTERS

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Application filed March 12, 1941

The present invention relates to a gastight housing for filters serving the filtration of solutions containing volatile solvents. Such enclosed filters are especially used for newer dewaxing processes by which the wax for the production of oils with a low pour point is separated out at low temperatures by means of solvents or mixtures of solvents such as acetone, liquid sulphur dioxide, solvent mixtures containing sulphur dioxide, mixtures of benzol and acetone, by means of propane etc. In industrial plants the separation of the wax is effected by means of continuously running filters, especially by rotary drum cellular filters, rotary disc filters and other continuously working filters.

Since the solvents preferably employed are volatile substances, or contain such substances, and since the filtration is effected at temperatures far below room temperature, the filter is installed in a housing that prevents gases from escaping from and moisture from penetrating into the shell. The filter shell is covered with a layer of cork or other heat insulating material.

In order to get access to the interior parts of the filter, the filter shell has been so designed that it may be opened up. At rotary drum cellular filters and rotary disc filters the filter housing consists of the filter bowl receiving the substance to be filtered, and the cover mounted gastight on the bowl by flanges with inlaid gaskets, e. g. a rubber strip.

Other continuously running filters are designed correspondingly, the filter being enclosed by a two-part housing, the upper part of which is mounted gastight on the lower one.

Considering the sizes of the housing required, the manufacture of completely plain flanges is very difficult and expensive. It may be added that the packing material put between the flanges is destroyed each time the cover of the housing is lifted so that it becomes necessary to inlay new, accurately fitting rubber strips before the cover is put back into position which proves to be very toilsome. In many cases it has been tried to avoid taking off the filter cover by entering the filter through manholes in order to carry out minor repairs inside the filter.

The working inside the closed filter is only possible if the interior of the filter room is free of poisonous or oppressive gases. This, however, does not prove to be the case if acetone, benzol or sulphur dioxide has been used. Even if such a filter were rinsed with washing liquid and ventilated, the filter and parts of slack wax remained therein contain still enough solvent to make work in the interior of the filter impossible without gas mask and protecting clothes.

The present invention proposes a device by which the filter housing is made gastight in a simple way and which allows taking off the cover and replacing it with much ease. According to the invention the rim of the lower part of the housing is provided with a groove in which the edged rim of the cover fits. The groove can be filled with a sealing medium.

The sealing of the filter is effected by filling the groove with the molten sealing medium and setting the cover into the liquid medium. The cover may also be set in first and the sealing medium subsequently applied. The latter must be easily fusible so that it can be filled in liquid form into the groove where it gradually solidifies after the cover is put in place.

If for any reason the opening of the filter becomes necessary the cover is simply raised. This can be facilitated by warming the solid or semi-solid sealing media. For this purpose a heating device e. g. a steam coil is provided in the groove. This coil is also to be heated when the cover is to be set back. Since now and then it may become necessary to drain the sealing medium from the groove, the latter is further to be provided with suitable drain cocks.

In some cases it may be recommended to fasten the filter cover to the lower filter part additionally with a few bolts.

In case of minor, only a few mm of water column overpressures or vacuum, a liquid may be applied as sealing medium. If however, the latter is to be used at higher pressure differences that would necessitate correspondingly high liquid columns for tightening, solid sealing media are to be preferred. It was found, for instance, that—filling a 150 mm deep groove up to 100 mm with wax—the filter remained tight at an overpressure of a 2 m water column.

As sealing media plastic substances, such as asphalt, artificial resins, and so on, are applied which on solidifying must not develop cracks. For dewaxing processes paraffin wax has proved to be especially advantageous for several reasons. It is a medium containing similar ingredients as the substance fed to the filters so that the filter is not contaminated if the medium filled into the groove by some reason flows over. It may be added that it is very resistant and neither attacked from the substance fed to the filters nor the solvent applied, and that it dissolves only little or nothing of the above mentioned liquids. These facts are especially to be considered when

applying sulphur dioxide as dewaxing medium. Also to sulphur dioxide wax has no affinity. In case f. i. wax would have a dissolving effect on sulphur dioxide—if even to a small degree—the sulphur dioxide would gradually penetrate the entire sealing media and from there get into the atmosphere.

Therefore, it is recommended as specially advantageous to apply wax as sealing medium for the device under discussion for processes in which a substance containing sulphur dioxide is filtered.

For the above purpose mainly soft waxes or also oil containing higher melting wax species may be used.

When sealing media are applied which in some way do not quite meet their requirements, wax may be added forming then the upper absolutely gastight and inert layer.

Furthermore, easily fusible alloys, preferably Woods-metal, Roses-metal, Newtons-metal, soldering tin or the like have proved to be very suitable for the above purpose.

Metals of the above kind or metal alloys, respectively, have melting points which allow a liquefaction in the sealing groove by means of a suitable heating device. When applying the above metals and metal alloys it is possible to attain a strongly reliable tightness between the upper filter part and the filter bowl, which also resists considerable vacuum and over-pressures. Moreover, the above metals and metal alloys, respectively, are insoluble in the solvents or precipitants, respectively, used for dewaxing.

In order to secure an absolutely reliable adhesion of the metals or metal alloys used as sealing medium to the walls of the sealing groove and the jointing surface of the upper part of the filter, the respective surfaces are to be polished and cleaned from oil before the sealing medium is applied. This can be done in the usual well known way.

Specially good tightening effects are attained in the following way: Coating the interior surface of the groove entirely or partly, preferably at the bottom, and the corresponding surface of the cover with a thin layer of a substance which homogeneously connects with the sealing medium. It can be recommended to use as suitable coating one or several components of the metal alloys which in the special case are to be applied as sealing medium. When tin-containing alloys are employed for filling the sealing groove, the walls of the sealing groove and the corresponding surface of the cover may be coated with a thin layer of tin before the sealing medium is applied. Furthermore, a coat of cadmium may be provided for the same purpose.

In order to make the tightening effect of the above sealing media still more effective it is recommended to extend the jointing surface to be dipped into the sealing medium by a special shaping. The surface to be dipped into the sealing medium may e. g. be hook- or T-shaped.

For certain purposes it may, furthermore, be desirable to provide additional safety against excessive stress. In such a case cramp-shaped holding devices may be used which hold the upper and lower part of the housing together.

The enclosed drawing shows the gastight seal as applied at a rotary drum cellular filter.

The filter drum **1** dips into bowl **2** on which the cover **9** provided with manholes **8** is mounted. The filter bowl is filled with the substance to be treated **3**. The upper rim of the filter bowl is provided with groove **4** which is filled half with sealing medium **7**. The gas cover **9** with its preferably T-shaped edge **10** dips into the sealing medium. The groove is provided with heating pipe **5** which may be heated by steam, and furthermore with cocks **6** by which the sealing medium may be drained, if necessary.

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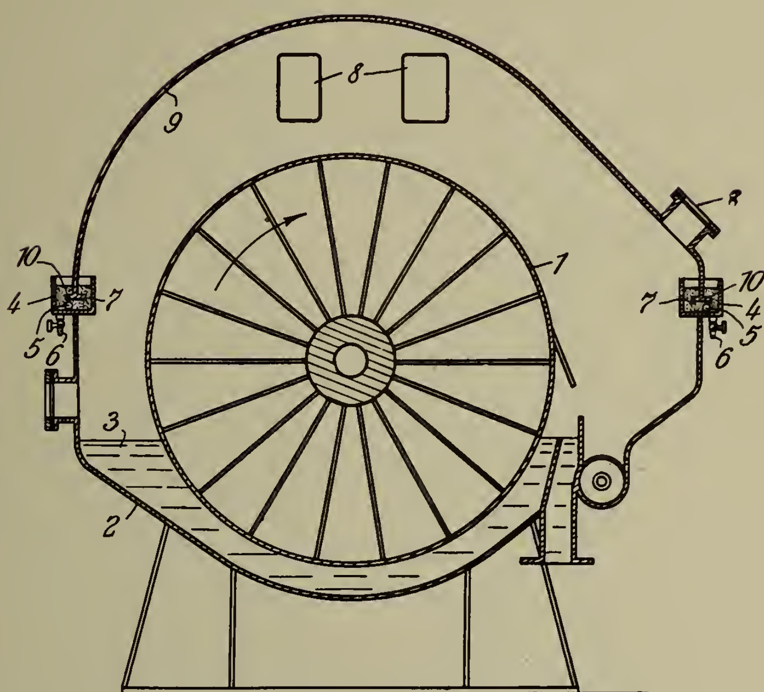

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ALIEN PROPERTY CUSTODIAN

WINDING FRAME

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The play of forces at the bobbin exchanging consists in the releasing and carrying out of a greater number of building up proceedings, for which additional accumulators of force in the form of springs, ropes, levers, cam discs and the like are kept ready in the single winding points or for groups of winding points. These individual forces are generally not especially great, so that their renewed keeping ready by re-tensioning, counter-pull and the like, even in quick running and sensitive winding frames with automatic change of bobbins, does not encounter any difficulties. The force required for the pulling out of winding spindles, the attendance of arrangements for replacing bobbins or the like is, however, considerable. It is further not only required instantaneously but must also overcome appreciable resistances up to the starting of the desired movements.

The invention starts therefore from the idea, to automatically accumulate and keep ready this force on the one side but so that its effect can be cut out directly at any time, and to derive on the other side the remaining building up proceedings substantially from this force. According to the invention this is attained thereby, that the force required for the bobbin-changing is taken from a flowing medium, and a control element at first influenced by this medium controls in turn the other building-up proceedings. The resistance opposed at the beginning to the bobbin changing is accounted for according to the invention, in that the flowing medium, before it becomes effective, is placed under increased pressure. As flowing media all known liquid or gaseous media are considered.

In special employment of the idea of the invention in winding frames, in which the winding spindle extends through the cop to be built up, or through the tube of the same, the winding spindle is equipped at one end with a piston which moves to and fro in a cylinder controlled by the flowing medium. In the path of movement of this piston a control plate shiftable in the axis of the cylinder is arranged and hingedly connected with a control rod which controls the different building-up proceedings. This special form offers the further advantage, that the control play, which may be held in its initial position for instance by spring force, presses in turn, after the control pressure of the flowing medium has decreased, upon the spindle piston and thereby pushes the spindle again into the counter-holding head of the winding point.

By this special construction a considerable simplification and acceleration of the bobbin-changing is attained also at the production of tubular cops. In order to facilitate the re-knotting of broken thread ends according to this acceleration, and in order to save time, the invention provides further details which assist the pulling of the tubular cop from the winding funnel and the finding of the broken thread ends at the cop point and further ensure against a premature becoming effective of the change of bobbins, which as such can easily occur at the bobbin movements necessary for the locking up of the thread and the like. According to the invention the slow turning back of the bobbin, known from cross-winding frames, is utilized amongst others.

Also the holding of the starting end of the thread at the beginning of the building-up of a fresh tubular cop is improved according to the invention, in that the counter-cone is equipped with notches extending obliquely to its axis and the winding funnel with an auxiliary thread-guide which oscillates the thread to in front of the funnel and thereby brings it into the range of the notches.

At the solution of the problem a separate reserve or delivery point of the flowing medium was provided for each winding point. In the further development of the idea of the invention considerable simplification in the construction of the whole machine is possible, if a common reserve- and delivery point for the flowing medium is coordinated to the winding points or groups of winding points and each winding point is equipped with a piston compressor, which at the beginning of the bobbin-changing begins to operate and causes a pressure increasing of the flowing medium becoming effective against the spindle piston. The flowing medium can then also be rendered useful through corresponding branch-conduits at the permanent pressing of the cop into the point funnel at the production of tubular cops or for instance of cops on short tubes.

The use of flowing media in the winding frames did lead further to the proposition, to provide blowing arrangements at each winding point, said arrangements preventing the collecting of flying dust very disagreeable just in rapidly running full-automatic winding frames, and inadmissible heating of certain machine elements.

When using gaseous flowing media these media may be used according to the invention as well as source of power as also for the blowing arrangements. The invention provides further that the blowing pressure at the initiation of the building-up proceedings is temporarily in-

creased, so that the gas, for instance the air taken from a general service-conduit for air under pressure, blows jerk-wise the corresponding points.

In order to further improve the cooling of certain machine elements and to make it possible to employ also in funnel-winding frames higher winding speeds, the jacket of the winding funnel has, according to the invention, a specially heat deflecting shape or it is made of heat well conducting material. With the same object in view the winding funnels may be equipped, according to the invention, with longitudinal, transverse or spiral-shaped cooling ribs or the like, whereby a better cooling is attained. The winding funnel may further be surrounded, according to the invention, by a double wall and in the hollow space thus produced no or only very short cooling ribs can be provided. Finally, closed passages may be formed, according to the invention, in double wall winding funnels by the ribs, whereby also a cooling with cooling liquid is rendered possible.

Several embodiments of the invention are illustrated by way of example in the accompanying drawing, in which

Fig. 1 shows a winding point in side elevation, partly in section,

Fig. 2, two neighbouring winding points in top plan view, the cover of the casing being removed,

Figs. 3 and 4 a counter-cone in side elevation and in front view,

Fig. 5 a diagram of the building up times,

Fig. 6 another construction of a winding point as shown in Figs. 1 and 2, all parts not necessary for the explanation being omitted,

Figs. 7 and 8 different positions of the main valve shown in Fig. 6,

Fig. 9 an other form of construction of a winding point corresponding to Fig. 1 partly in section,

Fig. 10 a simple winding funnel in axial section,

Fig. 11 a winding funnel with cooling ribs also in section,

Fig. 12 an axial section through a winding funnel with cooling ribs on the wall in side elevation with admission- and discharge conduits for the cooling medium,

Fig. 13 a corresponding section through a winding funnel with wall and closed passages with admission,

Fig. 14 the winding funnel as shown in Fig. 4 in end view.

Similar parts are designated by similar reference numerals in the different embodiments of the invention.

On the transverse girders 1, 2 of the winding frame the individual winding points are fixed the one directly at the side of the other by means of their casings 3 and in any desired number. The casing walls serve as bearing carriers, oil containers or oil catch and so forth, as usual in such constructions, and they are closed at the top by covers 4. A shaft 5 serves as source of power for all winding points. The tubular cop K which has to be built up is wound directly on the front end 6 of the winding spindle 7 between the top cone 8, the foot of which may be screwed into the casing 3, and the shiftable counter-holding head 9. Rods 10, 11 serve for guiding the counter-holding head 9 and different feeding elements, said head sliding on the rods by means of bushes 12 and 13. The winding spindle 7 is driven from shaft 5 through the intermediary of a gear wheel 14 meshing with a gear wheel 15 equipped with an inner cone, the hub of gear wheel 15 being mounted on a long bush 16 serving at the same time as journal for the spindle 7. A clutch sleeve 18 revolves together with the bush 16 on a slidable wedge 17 and revolves, on a stationary wedge 19, a gear wheel 20. One end of sleeve 18 forms a clutch cone 21 and its other end a flange 22. The clutch cone 21 engages under the action of a spring 23 with the inner end of gear wheel 15.

A thread guide 30 is moved from the gear wheel 20 by a gear wheel 25, shaft 26, crank 27, rod 28 and oscillatable arm 29. The thread guide 30 moves to and fro in front of a lateral slit or the top cone 8. During the laying of the actually foremost thread layer, the forming cop K is pressed, by a pull rope 31 on the slidable bush 12 and by means of a weight 32 or the like, into the top cone 8 and can be pulled out of the same, for instance when a thread breaks, by a handle 33 adapted to be secured in position. The winding spindle 6 together with the cop K can follow this movement without difficulty, as its correspondingly shaped end 34, i. e. a piston 35, slides in a cylinder 36 or in an inner ring 37 of the driving bush 16. A guide groove 38 maintains the driving connection between main shaft 5 and winding spindle 6, 7, when the clutch 15, 21 is engaged.

The front end of winding spindle 6 or the rear end of the cop K bear against the counter-holding head 9 in a specially constructed counter-cone 39, as shown in Figs. 3 and 4. This counter-cone 39 has three notches 41*a*, 41*b* and 41*c* cut obliquely to the axis of the spindle, the thread F being adapted to be caught in the points of intersection of these notches and clamped in the bore 40 of the cone when the spindle 6 is pushed in. This form of construction presents further the advantage, that the thread is centered also when the counter-cone does not revolve. For taking up a finished cop and for severing the thread the usual tipping tray 43 and scissors 43 are provided. The stop motion 44 is connected by a rod 45 with a short oscillatable arm 46 so that the clutch 15, 21 is opened at thread breaking.

Control rods 60, 61 serve for the transmission of the building up proceedings. The control rod 60 is connected by a double lever 62 with a sliding rod 63 in the cylinder 36, the control head 64 of said rod adapted to be shifted against the action of a spring 70 in a manner which will be hereinafter described. The control rod 61 is fixed at one end on the slidable bush 12 and carries at the other end a small tipping lever 65, which is held in the position shown in Fig. 1 by two levers 66, 67. The lever 67 controls by a shaft 68 a control lever 69, whereas the lever 66 can be influenced by the stop motion 44 through rods 71, 72.

The building-up proceedings themselves, after they have been started and the length of the cop has been reached, are propagated hydraulically by oil pressure. With this object in view, two passages 80, 81 are provided near the ends of cylinder 36 and connected with an oil reservoir 86 by tubes 82, 83, 84 and 85. A wheel pump 88 or the like serves for producing pressure, and check valves 87 serve for conducting the flow or for pressure equalization. Tube 83 may be connected by a control slide 90 either with tube 85, in the position shown in Fig. 1, or with tube 84. The slide 90 has, besides an angular bore, an annular groove 91 and is hinged-

ly connected by a rod 92 with a star lever 93, 94, 95 and 96, the arm 95 of this star lever engaging behind an elbow lever 97, 98 mounted on the same shaft as this star lever. A pin 99 of an elbow lever 100, 101 is adapted to act on arm 96 of the star lever, and with an arm 97 of this star lever a short two-armed lever 102, 103, or pawl, cooperates. The star lever and the two-armed lever 102, 103 are directly connected by springs, and the elbow lever 100, 101 is spring-controlled through the intermediary of a notch-lever 104, 105. The lever arm 101 can be influenced from the control rod 60 by abutments 105 and 106, the lever arm 103 by an abutment 107 and the tipping tray 42 by a hinge 108, 109.

A small bracket 120 is fixed on the front end of control rod 60 and carries a pin 121, on which a double lever 122, 123 and an elbow lever 124, 125 are pivotally mounted. The lever arms 123 and 125 are connected by a spring 126, the mutual oscillation of these arms being limited by a pin 127. The slidable bush 13 has an abutment 128 behind which the lever arm 122 may engage, and a connecting piece 129 of the rods 10, 11 has a short rod 130, between abutments 131, 132 of which rod the lever arm 124 moves, in order to temporarily couple the counter-holding head 9 with the control rod 60.

A notch bar 133 is fixed on control rod 60 and equipped with an oblique control face 134, control abutments 135, 136 and a control pin 137. The inclined control face 134 acts upon the guide pin 138 of an auxiliary thread guide 139, whereas the abutments 135, 136, the scissors 43 and the control pin 137 influence an oscillatable arm 140 serving as ejector.

The operation of the arrangement illustrated in Figs. 1 to 4 is as follows:

After the thread F hanging from the thread guide 30 has been clamped between the front end of spindle 6 and the counter-cone 39, the usual building up of the cop begins. The counter-holding head 9 gradually moves forward under the pressure of the thread layers in the right hand direction as shown in the drawing. If a thread breaks during the building up of the cop, the stop motion 44 oscillates towards the left and thereby separates the clutch 15, 21. The cop K in the course of building up and the spindle 6, 7 are then pulled forward from the funnel 8 and in this position fixed on rod 10. Even when the cop K, at the pulling forward for re-knotting the thread, has already attained a length at which the tipping lever 65 contacts with lever 67, this lever 67 cannot enter into operation, for the reason that, when the stop motion is oscillated off, the second counter-bearing, formed by the lever 65, is lacking for the tipping lever 66. The spindle 6, 7 follows the pulled-off cop as a certain oil pressure exists in bush 36. This oil pressure, as shown in Fig. 1, is produced thereby that, especially when the tube 84 is closed by slide 90, the pump 88 in the tube 82 produces a certain pressure limited by the check valves 87. After the re-knotting of the thread the bush 12 is released by means of the handle 33 and the cop pulled again into the funnel under the influence of the weight 32. The pulling force of weight 32 is greater than the oil pressure in the cylinder 36 or on the piston. If the point of cop K is again in the winding funnel 8, the stop motion 44 is moved forward in the usual manner, the clutch 15, 21 closed and the winding proceeding continues.

If the cop K has reached the predetermined length, the tipping lever 65 strikes on the levers 66, 67. As the lever 66 is for the time being held in its position by the stop motion 44, the lever 67 is oscillated in clockwise direction in the form of construction shown, whereby the locking lever 69 liberates the rotary star, so that this star under the action of its pull spring can cause the following control proceedings.

The arm 95 of the rotary star presses the arm 98 of the elbow lever 97, 98, rotating together with the rotary star on the same shaft, against the flange 22 of bush 18 and thereby releases the clutch 15, 21. At the same time the arm 93 of the rotary star pulls forward the rod 92 and thereby connects by the annular groove 91 the pump 88 with the aperture 81 in the cylinder 36. Under the pressure of the pump 88 the piston 35 is consequently shifted to the left in the example shown, wherefrom results that on the one hand the spindle 6 is pulled out of the finished cop K and on the other hand the plate 64 is pressed against the end of cylinder 36. The control rod 60 is hereby moved towards the right. The front end of the lever arm 102 of the pawl 102, 103 engages then under the arm 97 of the elbow lever 97, 98 whereby the clutch is held in the inoperative position. At the same time the arm 101 of the elbow lever 100, 101 is turned in clockwise direction, so that the pin 99 oscillates the arm 96 of the star lever into the position shown in Fig. 1 and therewith pushes the slide 90 back into its original position, so that, when the piston 35 of the spindle 6, 7 moves forward, the oil in front of this piston can flow back through the tubes 83, 85 to the oil reservoir 86. The notch lever 104, 105 assists the elbow lever 100, 101 to oscillate beyond its dead point position. Owing to the movement of the rod 60 towards the right the arm 124 at the front end of this rod is moved away from the abutment 132, so that the locking nose of arm 122 engages behind the abutment 128 and thereby, when the rod 60 continues to move, moves towards the right the bush 13 and by the same the counter-holding head 9. The cop K loses thereby its rear support. As further, owing to the movement of the notched bar 133 towards the right, the pin 137 pushes to the right the ejector 140 moving in the slit of the winding funnel 8, the front end of cop K is also removed from the funnel 8 which supports the same, and the cop drops into the tray 42 oscillated by the hinges 108, 109 in clockwise direction, said tray assuming in this instance a position, which corresponds to the oblique position assumed by the cop when sliding out of the funnel. As the pin 138 of the auxiliary thread guide 139 strikes against the inclined surface 134 of the forward moving notched bar, the cop is oscillated towards the funnel foot and the thread F is also moved forward against the funnel foot independently on the position of the thread guide 30, so that the thread end can hang through the open scissors and be severed by the same. In this position the hanging thread thrum is clamped between the winding spindle 6 and the counter-cone 39 when this spindle engages again into this cone, so that the thread thrum need be neither clamped by the scissors nor be wound first onto the spindle, as the head 9 liberated by the cop suddenly moves towards the left under the action of the weight 32 before the scissors begin to cut. The liberation of the counter-holding head 9 necessary herefor has been effected in the meantime, in that the plate 64, owing to the move-

ment of the slide 90 towards the right, is pushed again in the cylinder 36 under the action of spring 70. At this movement arm 124, which has been moved towards the right together with rod 60 as shown in Fig. 1 and elastically yielding relative to the abutment 131 has engaged behind the same, strikes then against the abutment so that the locking nose 122 is pulled upwards and detached from the bush 13. The thread thrum hanging from the auxiliary thread guide 139 down to the scissors is therefore caught in the notches of the counter-cone 39 and clamped by the spindle 6, which engages in the bore of this counter-cone. The necessary forward movement of the front end of spindle 7, 6 is imparted to the spindle also by plate 64 when this plate moves forward, as the plate 64 pushes the piston 35 in front of it. After the scissors have cut and the rod 60 has been pulled back, the tipping tray 42 assumes again the position shown in Fig. 1, whereby the cop which is in the tray can slip off for instance onto a conveying band.

The whole building up proceedings are again shown in the diagram Fig. 5 by way of example as regards time and travel. The diagrams of the individual elements are designated as follows: *a* for the spindle 6, 7, *b* for the clutch 15, 21, *c* for the counter-cone 39, *d* for the tipping tray 42, *e* for the ejector 140, *f* for the auxiliary thread guide 139, *g* for the scissors 43. The building up times are indicated in seconds by 0, 1, 2, 3, 4 and 5.

After the correct length of the cop has been attained, the spindle first moves a distance *h* of 260 mm (in Figs. 1, 2 and 6 towards the left, in Fig. 5 towards the right) and in a building up time of three seconds. For the last 60 mm the piston 35 pushes the plate 64 in front of it. During the last travel of 60 mm of the spindle 6, 7 the rod 60 is at the same time moved towards the right. In the diagram shown in Fig. 5 it is indicated by corresponding projections in downward direction which building-up proceedings are released and carried through during this travel of rod 60. These proceedings can also be seen directly from the diagram on hand of the above description.

After these building-up proceedings have been carried out, i. e. after the three seconds given by way of example, the backward movement of rod 60 begins and therewith under the influence of the cylinder spring 70 the forward movement of plate 64 or of piston 35. As the spring 70 must move plate 64 and piston 35 in opposition to the still filled cylinder 36, and as spring 70 possesses further a certain stiffness, a slightly longer time is required for the return movement of the rod 60 into its initial position, i. e. for carrying out the travel of 60 mm, as is also indicated in the diagram. Also in this instance the corresponding building-up proceedings are shown according to time and travel by projections in downward direction.

In order to facilitate the finding of the broken thrum when a thread breaking has occurred, a bush 151 with inner cone 152 is rotatably mounted on the cylinder 36, as shown in Fig. 6, which may be driven by a shaft 153. The flange 154 of bush 18 is constructed as clutch cone, so that the driving bush 16 of spindle 6, 7 can be brought under the action of shaft 153 instead of under the action of shaft 5. The shaft 153 revolves considerably slower than the shaft 5 and in opposite direction, so that at the backward movement of spindle 6, 7 or of cop K the thread thrum can be easily found. The engaging of clutch 152, 154 is effected by a three-armed lever 155, 156, 157 behind the arm 156 of which the arm 95 of the star lever engages as in the first form of construction. The arm 157 itself is under the action of a pressure piston 158 which is hydraulically driven as soon as the three-way cock 159 is accordingly turned into the position II, for instance by means of a rod 160. This rod 160 can be moved by a handle or a pedal through the intermediary of a lever 161.

Hydraulic force may also be used for pulling the cop K out of the winding funnel 8 for finding the end of the broken thread, in that for instance the cock 159 is turned into the position III shown in Fig. 7, whereby the pump pressure acts upon the piston 35 from the left, at the side of plate 64 and somewhat shifts the spindle 6, 7.

In Fig. 6 another construction of the means is shown, which can prevent the becoming effective of the reversing motor when the cop K is pulled back at breaking of the thread, especially when the length of cop has approximately been attained.

A three-armed lever 163, 164, 165 is mounted on a pin 162 and can be turned from the stop motion 44 or by means of a handle 166. A spring 167 holds this lever in the locking position together with a pawl 168, 169. At the breaking of the thread the lever 163, 164, 165 as can be seen from the drawing, is liberated by the stop motion 44 owing to the oscillating off of the locking pawl 168, 169. The arm 164 then acts against arm 165 and thereby releases the clutch 15, 21 without, however, closing the clutch 152, 154, whereas the arm 165 strikes against an arm 170 additionally mounted on the star lever and thereby locks this star against rotation, that is prevents a premature becoming effective of the building-up arrangement.

In the form of construction shown in Fig. 9 the liquid container 86 and the pump 88 for each winding point are omitted and replaced by a conduit 204 for pressure medium common for all winding points, this conduit being connected with the control cylinder by means of a control slide 181, a check valve 187 and a piston compressor 194, 196. The control of slide 181 is effected in the same manner as that of slide 90 as shown in Figs. 1 and 6 through a lever star 93, 94, 95, 98.

As the pressure medium from conduit 204 is permanently at disposal, the counter-holding head 9 can also be moved towards the cop K in order to press the same into the funnel 8 by means of the same pressure medium, instead of by counter-weight 32 as described with reference to Fig. 1.

With this object in view the main slide 181 has, besides the annular groove 91, longitudinal recesses 182, 183 and 184. A cylinder 186, which may be fixed on the connecting piece 180 of the guide rods 10, 11, can be connected by a conduit 185 with the distribution point 181 for the flowing medium. A piston 187 slides in the cylinder 186, one end of this piston being connected with the control rod 61 and, as the rod is connected with the slidable bush 12, tends to push the cop K into the top funnel 8 through the intermediary of the counter-holding head 9, as soon as an overpressure exists in the cylinder 186. A discharge 191 is further provided on the head of cylinder 186 and is closed by a check valve 190 and acts as blowing funnel towards the winding point, as soon as a gaseous medium is employed and a

corresponding overpressure is produced in the cylinder 186.

The distribution point or the slide 181 can further be connected through a conduit 192 with a cylinder 193 of a piston compressor, in which a piston 194 slides, which by a rod 195 can press against a smaller piston 196. This piston 196 slides in the other cylinder 197 of the compressor which at the same time brings into connection the conduits 83 and 84, when the slide 181 is in corresponding position. The cylinder 197 may besides also be connected by a conduit 198 with a conduit 199 terminating in the atmosphere.

Finally a conduit 200, 201 is provided, which terminates in an annular groove 202 in the driving bush 16, said groove having passages leading to the spindle 7 and, in the form of construction shown, branches from the part of cylinder 36 facing the winding point.

About the operation of the just described form of construction the following has to be said:

During the building-up of cop K the slide 181 is in the position, which can be directly seen from the drawing, i. e. the conduit 84 branched for instance from the general conduit 204 for air under pressure communicates with the cylinder 186 by means of the conduit 185 and presses, by means of piston 187, rod 188, transverse piece 189 and rod 61, the counter-holding head 9 towards the left and thereby the cop K into the top funnel 8. The valve 190 is then adjusted so that part of the air under pressure blows from the funnel onto the winding point. As the counter-holding head 9 is moved, at the bobbin exchanging towards the right in the form of construction shown, by means of the main control rod 60, after the catch lever 122 has engaged or when the thread breaks, by pulling forward the hand lever 33, a sudden increase of pressure must occur in the cylinder 186, especially if, owing to the movement of the slide 181 to the right, especially in the form of construction shown, when the conduit 185 is closed at the distribution point, this sudden increase of pressure strengthening for a moment the blowing flow, so that settling of flying dust just during the switching proceeding is prevented in specially effective manner.

In a similar manner the flow of air under pressure blown through the conduit 200 or blown through the leakages in the spindle guide towards the point of the cop is increased, as soon as the piston 35, in the form of construction shown, is moved towards the left for pulling out the spindle 6, 7 from the cop K.

In order that the starting resistance, which the spindle opposes to the pulling out, can be overcome more easily, the slide 181, at its movement towards the right as shown, does not only connect the conduits 83, 84 by means of the annular groove 91, but it establishes simultaneously the connection between the conduit 84 and the conduit 192. Consequently the flowing medium in the cylinder 197 is pressed together in the ratio of the surfaces of the pistons 194 and 196 and with corresponding increase of pressure acts upon the piston 35 at the first moment.

According to the invention amongst others the elements exposed to heating have to be cooled. As such element the winding funnel is chiefly to be considered. To realize this idea, a feed pipe 205 for cooling air has above the funnel 8, as shown in Fig. 10, an air outlet 206 for the cooling air, through which outlet the air current can flush along the winding funnel on the whole extension of the same. The tube 205 may also engage concentrically over the winding funnel 8 wholly or partly, have several air outlets 206 and be connected with main conduit 204.

In Fig. 11 the winding funnel 8 has ribs 207 for increasing the cooling effect.

Fig. 12 shows a winding funnel with double wall 208 and with short cooling ribs 209, the admission and discharge conduits 210, 211 for the cooling medium being carried out elastically, so that the winding funnels may be movably arranged, if desired.

Figs. 13 and 14 show finally a winding funnel with double wall 208 and continuous ribs 212, by which passages are formed.

The winding funnels according to Figs. 12 to 14 are especially suitable owing to the wall besides for air cooling also for the use of liquid cooling media, provided that in this instance, as in the arrangement shown in Figs. 13 and 14, means for discharging the cooling media, similar as in Fig. 12, are provided.

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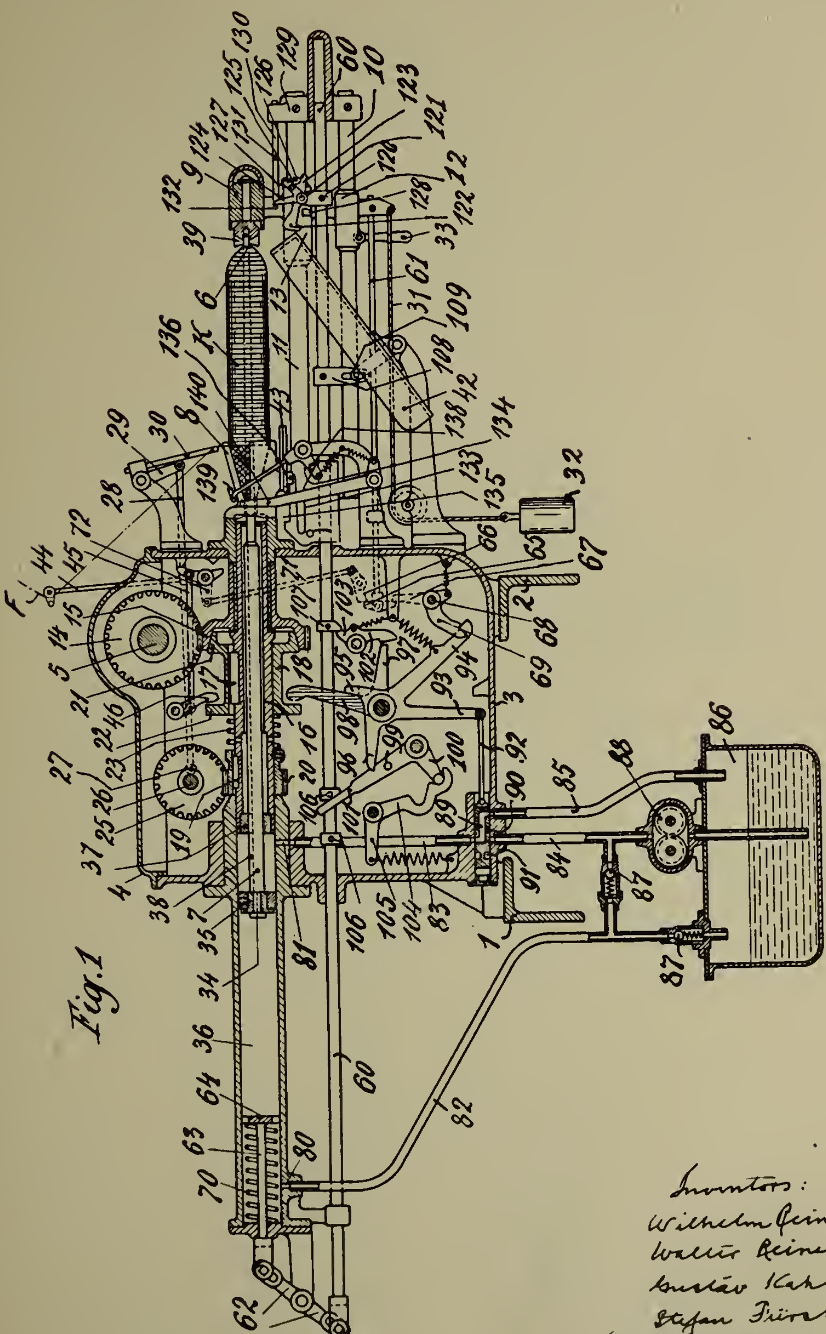

Fig. 1

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Fig. 2.

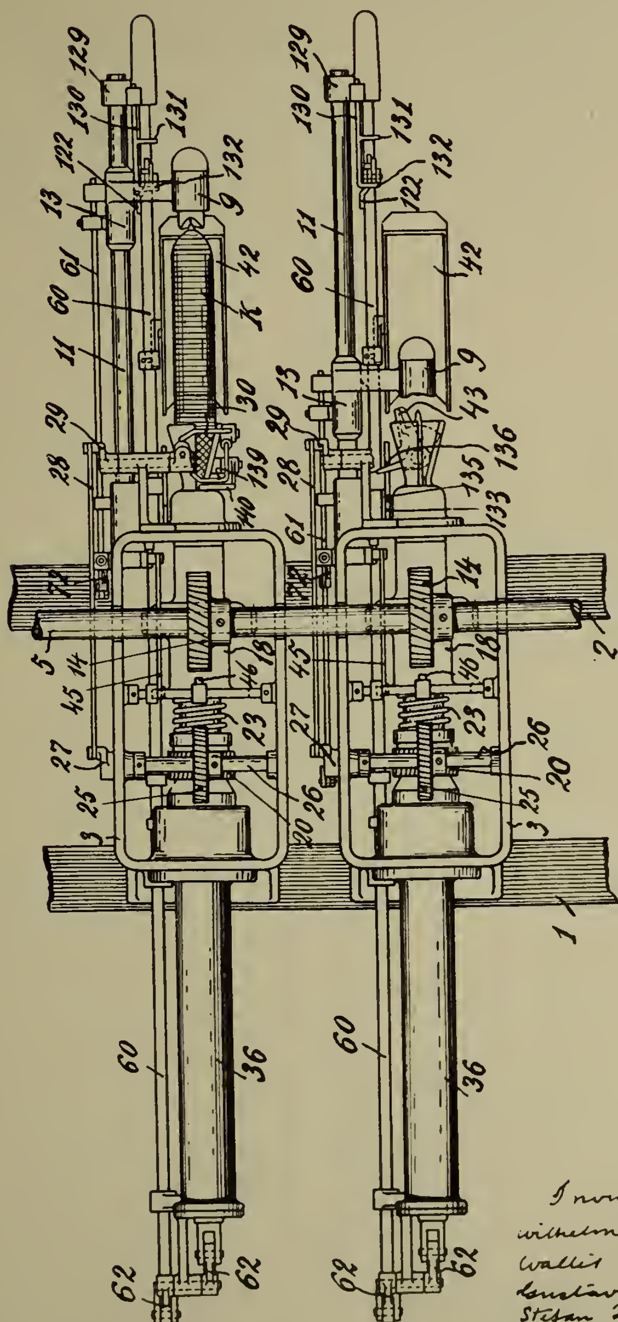

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Fig. 3.

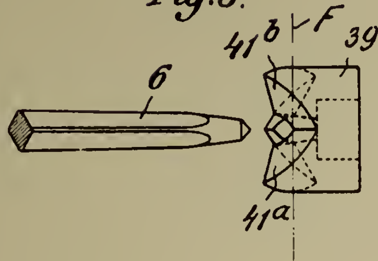


Fig. 4

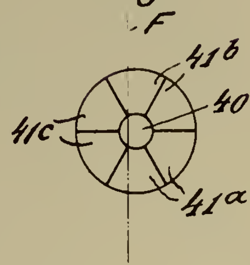
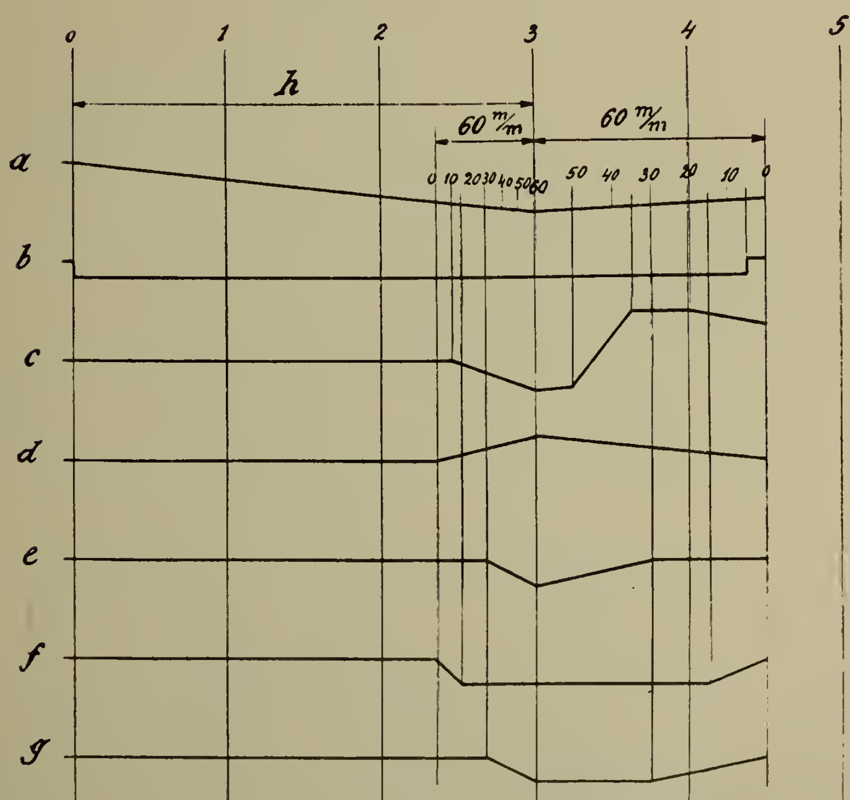


Fig. 5.



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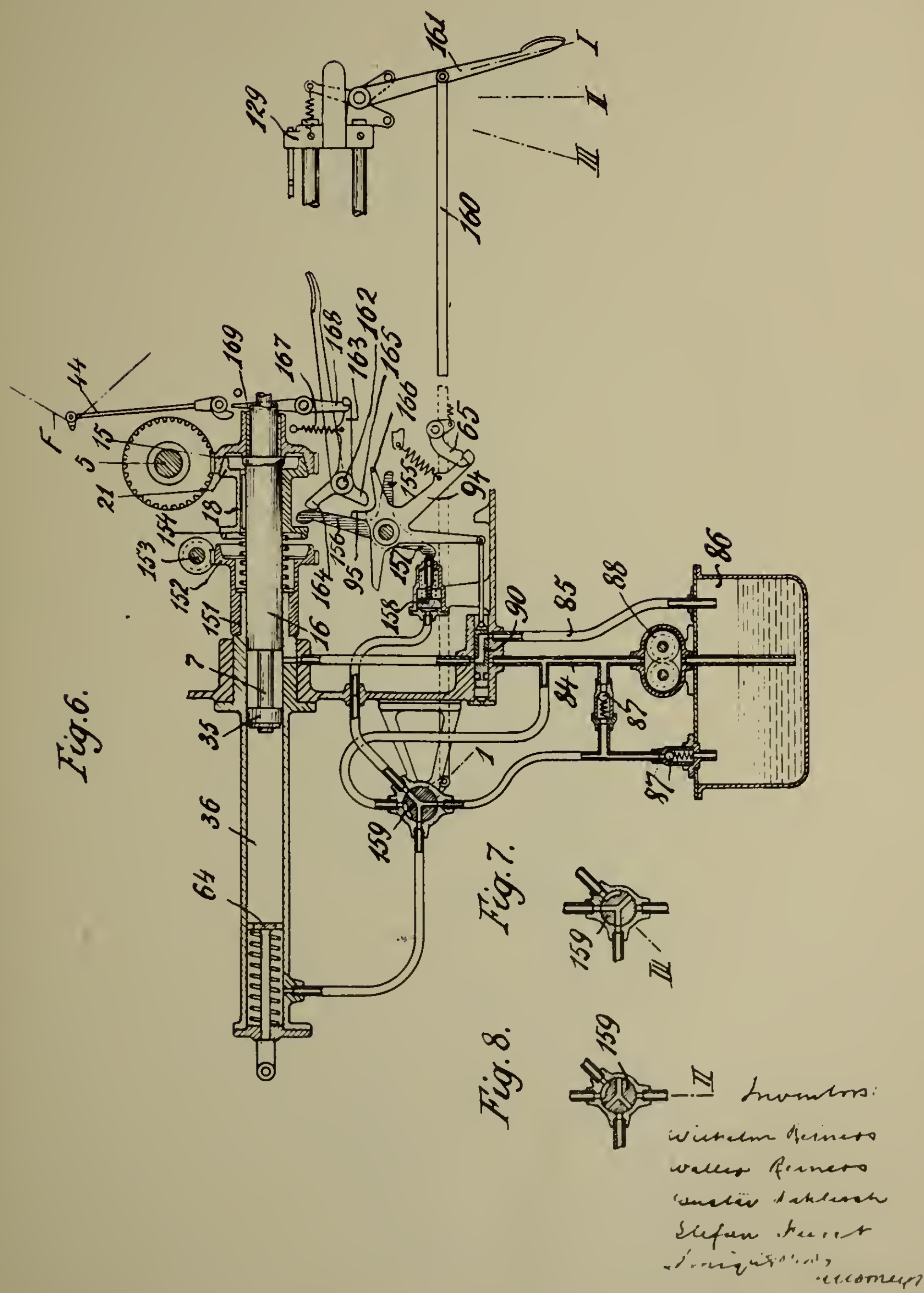

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Fig. 9.

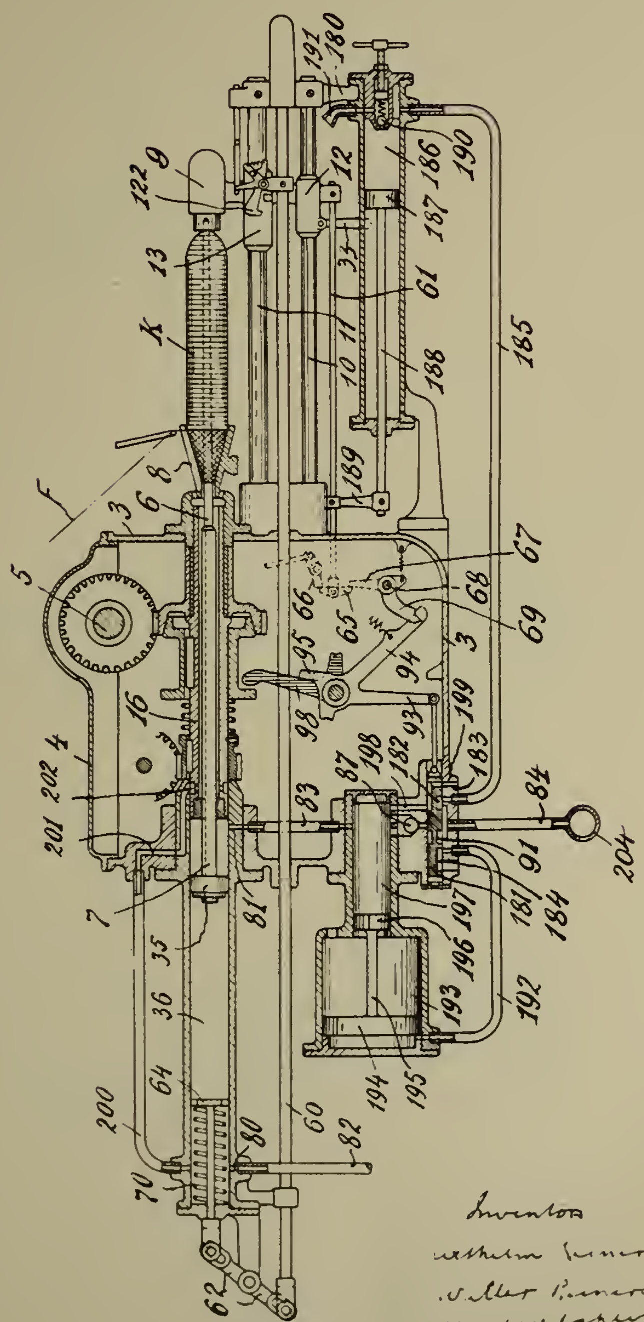

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Fig.10

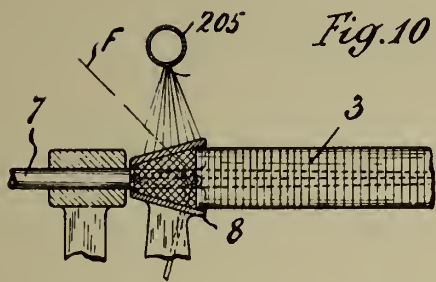


Fig.11

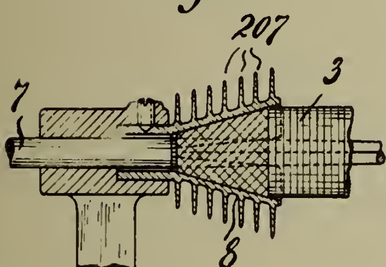


Fig.12

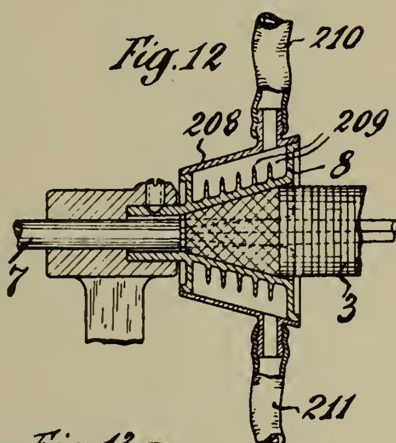


Fig.14

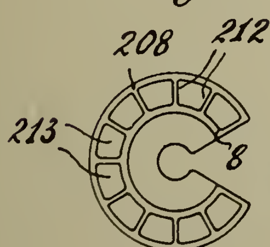
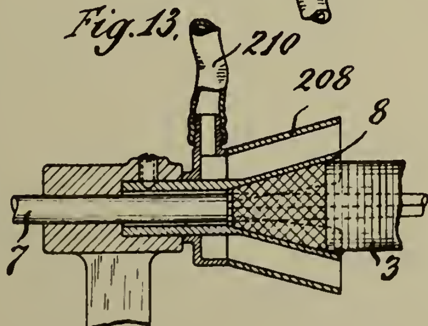


Fig.13.



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ALIEN PROPERTY CUSTODIAN

AIRCRAFT WING

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Application filed March 15, 1941

This invention relates to an aircraft wing.

For reasons of speed, airplanes are frequently provided with wings of small thickness and span, which involve a high landing speed and require a long runway. In order to overcome the disadvantages connected with this type of aircraft it has been proposed to increase the lift in landing and taking off by rendering the wings extensible transversely to the direction of flight.

According to one of these proposals the wing is equipped with two longitudinal spars and three extensions rigidly interconnected by the wing tip cap, which can be inwardly and outwardly moved transversely to the direction of flight and each of which resists bending and twisting forces, the first extension being positioned before the front spar, the second between the two spars and the third in the rear of the back spar.

In a wing of this construction the spars, the ribs and the stringers running parallel to the spars and connecting the ribs form direct bearings and guides for the wing extensions which are difficult to move in view of the great frictional forces concerned and tend moreover to seize and jamb.

The invention eliminates these troubles by providing the stringers running parallel to the spars with rollers which act as bearings and guides for the movable wing extensions and which are arranged above and below them, particularly near the spars and within range of the leading and trailing edges of the wing.

The advantages afforded by the invention consist in insuring good guiding of the wing extensions without any appreciable increase in weight and also an easily movable arrangement thereof, since the rollers themselves have little weight and the stringers bearing them can serve also for another purpose. The rollers safely take up the static and dynamic forces developing in flight and through the stringers conduct them to the supporting structure of the wing, the roller bearings located near the spars particularly transmitting the bending forces and those disposed within range of the nose and trailing edge of the wing the twisting forces and front compression stresses. The extension surfaces while subjected to the action of the aerodynamic forces can be moved in and out without any considerable expenditure of energy.

One form of the invention is illustrated by way of example in the accompanying drawing, in which

Figure 1 is a view of an aircraft wing according to the invention with its extensions moved outwardly and

Fig. 2, a detail view.

In the wing construction shown in Fig. 1 the numeral 1 designates a single wing of an aircraft, not shown, and 2 designates a longitudinal spar disposed approximately in the middle of the wing and connecting the members or ribs 3 extending transversely thereto. The ribs 3 possess recesses 4 in front of and in the rear of the spar 2 for accommodating wing extensions 5, 6 which can be moved inwardly and outwardly transversely to the direction of flight. Each of these two extensions or auxiliary wings 5, 6 is capable of resisting bending and twisting and both are rigidly interconnected by a wing tip cap 7 so as to prevent twisting relative to each other, a portion of the torsional forces being taken up by the strong ribs 10 in the front auxiliary wing 5.

The stringers 8 forming part of the static structure of the wing 1 and extending parallel to the spar 2 are provided according to the invention with rollers 9 which are disposed at a short distance from one another and serve for safely bearing and easily guiding the wing extensions 5, 6. To this end, they are arranged above and below the extensions, particularly near the spar 2 and within range of the nose and trailing edge of the wing.

The gap 5*a* produced when the auxiliary wings 5, 6 are extended is covered on the upper and lower sides of the wing by yielding strips 11 each of which is guided in channels 13 of the extensions 5, 6 and positioned with one end in the cap 7 so as to disappear while the other end is connected to a traction member 12 in the wing 1. The strip 11 can thus be moved at will from the inside of the aircraft or displace itself automatically. To effect automatic displacement it suffices already to secure the end of the strip to the wing 1, and automatic disappearance can be brought about by providing for instance in the cap 7 a winding roll 15 driven by spring, etc. When the extensions 5, 6 are moved in, the cap 7 closely fits the end 14 of the main wing 1.

The invention is of course not restricted to aircraft wings having one main longitudinal spar and two wing extensions or auxiliary wings.

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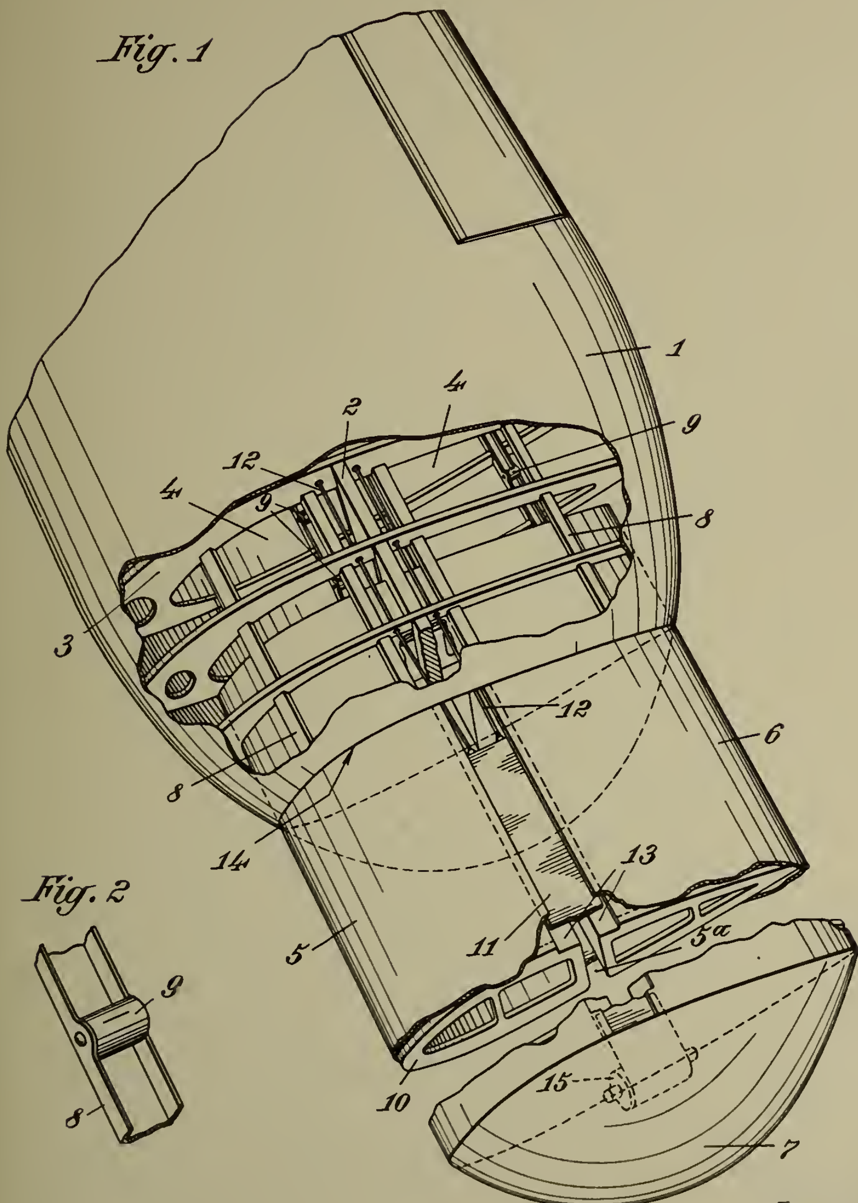
Fig. 1



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ALIEN PROPERTY CUSTODIAN

PERCUSSION DRILL FOR DRILLING HARD ROCK

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Application filed March 22, 1941

The invention relates to a percussion drill for drilling hard rocks by means of pneumatic or electric drilling hammers. The difficulties which occur at the drilling of hard rocks are numerous, especially so-called permanent fractures occur on the drill-rods at those points at which changes of cross-section exist, because at these points the oscillations caused by the percussion effect of the drill hammer combine to so-called oscillation knots. The strong lateral wear of the cutting edges effects clamping of the drills already after a short drilling time. The cutting-edges become blunt very rapidly, wrong hardening, especially overheating at the hardening causes premature fracture of the cutting edges or premature getting blunt.

Rock percussion drills have already become known, in which for preventing fractures due to oscillation the longitudinal bore of the drill tube is widened between the end to be inserted and the drilling crown beyond the measure necessary for the flushing. These drills possess, however, the inconvenience that the transition points from the drill tube to the insertion end and to the drill break very easily whereby the whole drill becomes unfit for use.

All these inconveniences are obviated according to the invention and an unimpeded drilling in the hardest rock parties is ensured. With this object in view, the rock drill is according to the invention composed of several parts which may be detachably connected to form a tool, so that rapid exchanging of the individual parts is possible without longer interruption of work. The drill is composed of a bit or head with cutting edges, a drill tube the widened longitudinal bore of which extends over its whole length or of several drill tubes, and of one or several detachable connecting elements connected with the drill tube and having a bore of reduced diameter. In such a drill the individual parts, according to the stress to which they are submitted, can be adapted to the object for which they are to be employed as regards kind of steel, heat treatment such as hardening and refining.

For the connection of the individual parts sleeves, cones or screw-threads may serve. Conical connections have proved to be especially practical, and in the interior of each drill tube conical widenings are preferably provided at the ends, destined to receive the corresponding end cones of the detachable connecting elements. The drill tubes can be produced in longer sections by rolling or drawing and then cut off to the actually required lengths, whereby the keeping in store is simplified. By the insertion of the intermediate pieces it is possible to drill a bore hole to any depth. Practically only one single rock drill head is required, which is practically equipped with plate-shaped inserts of high quality special steel or hard metal, as a drilling tube which is not sufficiently long can be lengthened by a second tube and, if desired by more tubes. The intermediate pieces can be produced with an external diameter which is greater than the diameter of the drill tube, so that at the same time a straight and good guiding of the tube in the bore hole is ensured.

Several embodiments of the invention are illustrated by way of example in the accompanying drawings, in which:—

Fig. 1 shows in side elevation a rock drill head of steel,

Fig. 2 in side elevation an intermediate piece or drill nipple for connecting a rock drill head with the drill tube,

Fig. 3 in top plan view a rock drill head with inserted carriers for the cutting edges made of hard metal,

Fig. 4 a side elevation of Fig. 3,

Fig. 5 in side elevation a rock drill head with a conical connecting pin,

Fig. 6 a drill tube,

Fig. 7 a connecting nipple as intermediate piece for the connection of several drill tubes,

Fig. 8 a hammer nipple as connecting piece between drill tube and drill hammer, and

Fig. 9 a complete rock percussion drill.

In Fig. 1 the rock drill bit or head 1 is made of cast steel or of a special steel and has cutting edges 2. A bore 3 in the head extends up to the cutting edges and serves for the passage of the flushing liquid. In the lower part of the head an internally threaded bore 4 is provided, by means of which the drill head can be screwed onto an intermediate piece 5, shown in Fig. 2. The intermediate piece 5 has, with this object in view, at one end an externally threaded extension 6 of shorter diameter, on which the head 1 is to be screwed by means of the bore 4 until its lower edge comes to bear against the projecting face of the intermediate piece 5. The lower end 7 of the intermediate piece 5 is conical and adapted to engage into a corresponding conical widening of the drill tube. A longitudinal bore 3 in the nipple serves as passage for the flushing liquid.

The rock drill head shown in Figs. 3 and 4 corresponds substantially to the drill head shown in Fig. 1, but in this instance special hard metal or

hard steel cutting edges 8 are provided for the bursting work. These cutting edges are embedded in the drill body 1 so that they are enclosed on all sides by this body and only the cutting edge remains free. The inserts 8 of hard material are hardly soldered or welded with the head 1.

In the embodiment illustrated in Fig. 5, the drill head 1 has a conical extension made in one piece with the drill head, the flushing bore 3 extending also over the whole length of the drill head. The diameter of the bore 3 is selected so that the flushing liquid is accelerated at the discharging. As fractures from oscillation occur frequently at the point designated by the line S—S, an intermediate piece as shown in Fig. 2 is preferably used in expensive hard metal percussion drills.

Fig. 6 shows a drill tube 10 open at both ends, the inner longitudinal bores 11 of this tube being wider than the dimension of 7 mm diameter required for the flushing, i. e. up to about 20 mm. At the ends of the drill tube 10, the bore 11 merges into conical widenings 12, which are destined to receive the detachable parts, such as drill head, drill nipple and hammer nipple. The widened longitudinal bore imparts to the drill tube 10 an increased resistance moment against oscillations at stresses due to shocks and therewith also a greater resisting capability against fractures due to oscillation. The inner bore 11 can be produced absolutely smooth by a drawing proceeding at the production of the drill tube 10, so that no projections or notches and similar unevennesses exist as according to the known rolling method and which might give cause for rusting influences by the flushing water. By the provision of the widenings 12 at both ends of the drill tube, any drill tube can also be used upside down.

For the connection of several drill tubes 10 the one with the other connecting nipples 13 as shown in Fig. 7 may be used which have corresponding outer cones 7 one at each end and also a continuous flushing bore 3. The diameter of the collar 14 of the nipple 13 located between the conical ends is preferably so great that it serves at the same time for guiding the drill tube on the wall of the bore hole. It is, however, advisable in this instance to provide longitudinal grooves 15 in the outer wall of the collar 14 through which grooves the bore dust can pass.

The still free end of the drill tube can be closed, as shown in Fig. 8, by a hammer nipple 16, which has at one end also a conical pin 7, whereas on its other end a square or hexagon head 17 is provided adapted to be inserted into the drill hammer. The hammer nipple has further a cylindrical shank 18, on which the flushing head is pushed, by means of which the flushing liquid is conducted into the drill tube through the lateral bore *3a* extending at an angle from the flushing bore 3.

Fig. 9 shows a complete rock drill according to the invention. This drill ensures an economical drilling in the hardest rock, the individual parts being detachable and adapted to be exchanged when worn or damaged. For regrinding the cutting edges it is only necessary to remove the rock drilling heads, whereas the other elements remain on the working places, this being a serious advantage especially in depths up to 2000 m practically occurring in some mines.

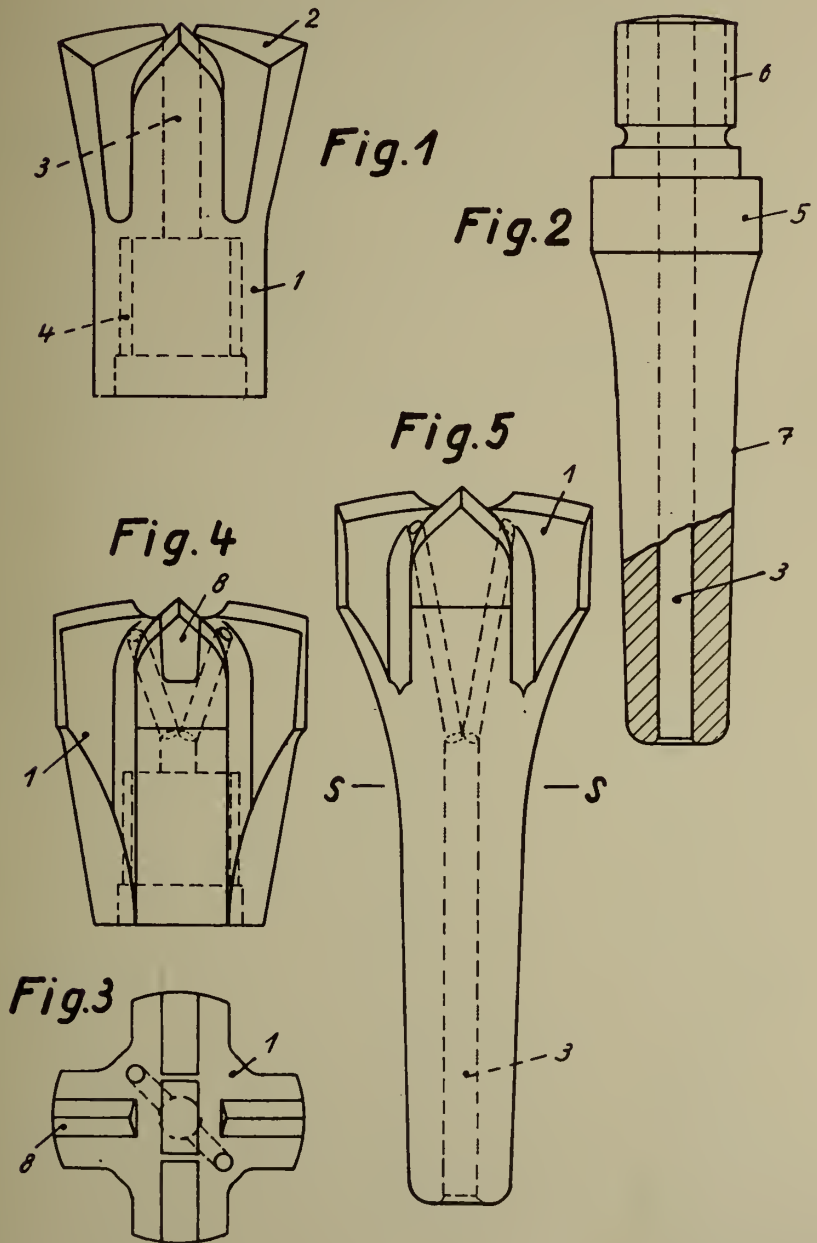
In certain cases it is advisable, to provide on parts of the drilling arrangement a protecting layer, especially on the outer end face of the seat of the flushing head, which must have a sliding face for the flushing head which is as rust-proof as possible. Any suitable protecting coatings may be employed herefor, which are adapted to withstand the rust formation, such as for instance coatings which are produced by galvanizing, further by burning-in of a metal or by enameling. Such a part coated with a protecting layer 18 is shown in Fig. 8. By the coating of this part, the rubber rings in the flushing head are exposed to very little wear so that in service they last often for months.

ADOLF MEUTSCH.

PUBLISHED
MAY 25, 1943.
BY A. P. C.

A. MEUTSCH
PERCUSSION DRILL FOR DRILLING HARD ROCK
Filed March 22, 1941

Serial No.
384,737
2 Sheets-Sheet 1



Inventor:
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Attorneys

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MAY 25, 1943.	PERCUSSION DRILL FOR DRILLING HARD ROCK	384,737
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Fig. 6

Fig. 7

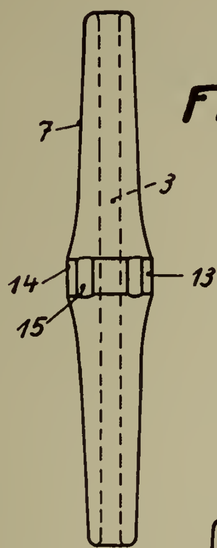


Fig. 8

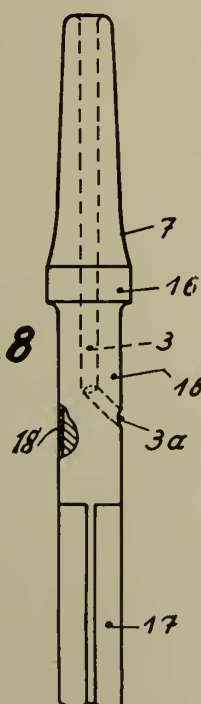
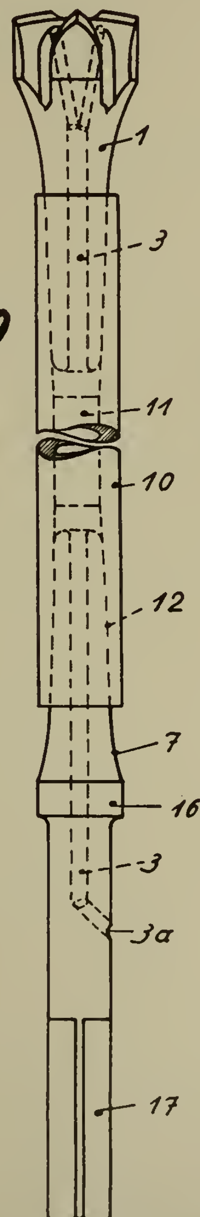


Fig. 9



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Published May 25, 1943

Serial No. 384,741

ALIEN PROPERTY CUSTODIAN

PRODUCTION OF CATALYSTS

Mathias Pier, Heidelberg, Wilhelm v. Fuener and Kurt Peters, Ludwigshafen-on-Rhine, Germany; vested in the Alien Property Custodian

No Drawing. Application filed March 22, 1941

The present invention relates to a process for the production of catalysts possessing good mechanical strength, i. e. high stability of shape.

We have found that catalysts of high activity and high stability of shape are obtained by admixing an iron salt in the presence of water with ammonium sulphide, eliminating the ammonium salt formed either by carefully washing the precipitate with water or by decomposing it by an addition of oxides or hydroxides of such polyvalent metals as form salts with the acid radicle of the ammonium salt which are stable up to at least about 500° C, preferably up to about 600° C, mixing the precipitate with one or more thio salts of ammonium containing metals of the 6th group of the periodic system in their acid radicle, heating the mixture to temperatures of more than 300° C until the evolution of ammonia subsides or comes to an end, and shaping the mass so obtained, if desired.

The iron salt may be dissolved in water or suspended therein, ferrous sulphate being preferred, but other salts, as for example, the chloride, nitrate, carbonate, acetate, formate, oxalate of divalent or trivalent iron or salts of other organic acids may be employed as well. According to the invention, it is essential in order to obtain a catalyst of good efficiency and mechanical strength that the ammonium salt, for example ammonium sulphate, contained in the ferrous or ferric sulphide obtained by preicpitation which still adheres to the precipitate separated, should be completely eliminated. This is achieved, for example, by thoroughly washing the precipitate with water after it has been separated by filtration or centrifuging, ammonia or ammonium sulphide being added to the washing water, if desired. This washing generally must be done for at least 8 to 20 hours, until the acid ion of the ammonium salt at the most in traces be found in the washing water. As an alternative, the ammonium salt may be decomposed by admixing the precipitate, after or before its separation from the solution, with oxides or hydroxides of magnesium, calcium, barium, strontium, beryllium, cerium, lanthanum or zirconium or mixtures thereof, in an amount of about 0.5 to 20 per cent, calculated with reference to the ferrous or ferric sulphide. The ammonium salts, for example ammonium sulphate, are thereby converted into magnesium, calcium or barium sulphate etc. which do no harm to the catalyst and remain stable even at temperatures above 500° C.

The mixture, if desired after being freed from water by filtration, or after being purified by prolonged washing as set forth above, is then mixed with solid ammonium thiomolybdate or ammonium thiotungstate or both in an amount of from 10 to 40 per cent, especially from 15 to 30 per cent. In addition, the mixture may be admixed with nickel or cobalt carbonate, nitrate, oxalate, acetate or formate in an amount of from 0.1 to 10 per cent, especially from 0.5 to 4 per cent. These metals are advantageously added in the form of complex salts, for example nickel-ammonium oxalate, formate or acetate, and such addition is preferably made only after the addition of the molybdenum or tungsten compounds. The resulting mixture, either in the moist state or after having been dried, for example, at from 100 to 200° C, is then heated, preferably in a finely ground state and advantageously in a current of inert or reducing gases, as, for example, hydrogen or hydrogen sulphide or carbon dioxide or nitrogen or mixtures thereof, at temperatures of from 300 to 500°, preferably 375 to 475° C, for a substantial length of time until the evolution of ammonia subsides or comes to an end. The heating is advantageously carried on until the amorphous iron sulphide has been converted practically completely into the crystalline (hexagonal) form. The time of heating required for this purpose may vary between about 1 and about 24 hours. The mixture thus treated is then shaped, if desired, for example with the aid of a pill-press. The moist mass containing iron may also be admixed with a small quantity of graphite prior to drying, which causes the mass to solidify to hard pieces on drying and eliminates the necessity of an additional shaping.

The catalyst prepared according to the present invention possesses both a high efficiency and a very great mechanical strength. It is excellently suitable for carrying out reactions with carbonaceous materials in which deposition of carbon is liable to occur, especially for the cracking of hydrocarbon oils, the destructive hydrogenation of coals, tars and mineral oils or the reforming, isomerization, dehydrogenation and alkylation of hydrocarbons. The catalyst can be employed with special advantage in the refining hydrogenation.

The following examples serve to illustrate how the present invention may be carried out in practice, but the invention is not restricted to these examples.

Example 1

From an aqueous solution of ferrous sulphate

($FeSO_4 \cdot 7H_2O$) of 30 per cent strength, ferrous sulphide is precipitated by means of a solution of ammonium sulphide of 15 per cent strength at from 60° to 80° C. The excess ammonium sulphide is removed by evaporation, the ferrous sulphide precipitated is filtered off in a filter press and washed with water until a sample of the washing water, upon addition of barium chloride and hydrochloric acid, no longer yields a precipitate but only shows a slight turbidity. The filter cake is sucked off until it is substantially dry, the percentage of iron sulphide therein is determined analytically, and the mass is well mixed with solid ammonium thiotungstate and a small amount of dissolved ammonium-nickel oxalate. The mixture is heated at 120° C approximately to dryness, ground through a screen and treated with hydrogen at 440° C in a tubular kiln with an internal conveyor worm; the hydrogen is then displaced by nitrogen, whereupon the mass is completely cooled and pressed to pills in a dry state. The solid catalyst contains 75 per cent of ferrous sulphide, 22 per cent of tungsten sulphide and 3 per cent of nickel sulphide.

Over this catalyst are then passed the vapors of a distillate of a heavy oil which had been obtained by the destructive hydrogenation of mineral coal according to the method described in the copending application Ser. No. 318,831, filed February 14, 1940, together with 3 cubic meters of hydrogen for each kilogram of initial material per hour, under a pressure of 600 atmospheres, at a rate of 0.5 kilogram of initial material per liter of catalyst space and per hour, the temperature in the reaction space being raised from 400 to 440° C. The reaction product obtained contains 68 per cent of constituents boiling up to 325° C. They are an excellent Diesel oil. The higher-boiling constituents are recycled to the reaction chamber for further treatment.

A catalyst composed of the same percentages as mentioned above of ferrous sulphide, tungsten sulphide and nickel sulphide, but prepared with the aid of the finished sulphides (the tungsten sulphide being precipitated from ammonium thiotungstate and the ferrous sulphide and nickel sulphide being precipitated from a solution of ferrous sulphate and ammonium-nickel oxalate, respectively), in contrast to the foregoing, yields a product which only contains 59.5 per cent of constituents boiling up to 325° C. This catalyst presents the further disadvantage of being inferior in strength and falling to small pieces or powder after some time.

Example 2

The ferrous sulphide precipitated according to Example 1 is filtered off and mixed, without being washed, with 2 per cent of magnesium oxide. The mixture is then worked up as in Example 1 with ammonium thiotungstate and a solution of ammonium-nickel oxalate.

Over this catalyst are passed the vapors of a middle oil obtained by the destructive hydrogenation of mileral coal and containing 16 per cent of phenol and 1.5 per cent of organic nitrogen compounds, together with hydrogen under a pressure of 250 atmospheres, at a rate of 0.8 kilogram of initial material per liter of catalyst space and per hour, at a temperature of 430° C. A middle oil free from phenol and organic nitrogen compounds is obtained along with slight quantities of gasoline. The middle oil is then passed, together with hydrogen, over a bleaching earth known in the trade as "Terrana," which is provided with 10 per cent of tungsten sulphide, under a pressure of 250 atmospheres at 400° C and thus converted into a gasoline boiling up to 190° C and having an octane number of 74, which is raised to 90 by the addition of 0.09 per cent by volume of tetraethyl lead.

MATHIAS PIER.
WILHELM v. FUENER.
KURT PETERS.

ALIEN PROPERTY CUSTODIAN

GREASING AGENT

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No Drawing. Application filed March 24, 1941

For greasing the fibers before spinning mostly oleic acid or fatty oils have been used, either as such or emulsified by soap or other emulsifying agents. Besides, greasing agents containing mineral oils have also been used, these greasing agents being however less advantageous, because the washing out of the mineral oils from the yarns and tissues often proves to be difficult. It has also been proposed to use glycerol or diethylene glycol instead of the usual greasing agents based on fatty acid, fatty oils or mineral oils. Glycerol and diethylene glycol give a certain slip to the fibers to be spun, however these agents are not able to retain moisture sufficiently and to produce sufficient adhesion between the singular fibers of the spun thread. These drawbacks are important especially when cellulose staple fiber or regenerated wool or waste, which contains many short fibers, are admixed to the spinning material. Compared with oleic acid, glycerol and diethylene glycol have the drawback, that they have themselves no washing and fulling power.

It has now been found, that mixtures of water-soluble, bivalent or polyvalent aliphatic alcohols or ether alcohols or of water-soluble high-boiling hydroaromatic or heterocyclic alcohols on the one side and of water-soluble salts of cellulose ether carbonic acids, which can also be called cellulose hydroxyparaffin monocarboxylic acids, especially alkali salts of these acids, on the other side are very advantageously applicable as greasing agents of fibers of all kinds before spinning. High boiling alcohols are such with a boiling point above 150° C. Especially suitable are alcohols or ether alcohols of high viscosity, as for example glycol, glycerol, propane diol, diethylene glycol, mono-n-butyl-glycerol ether and its homologes. However, also alcohols of lower viscosity, for example cyclohexanol or tetrahydrofurfuryl alcohol, are suitable. Instead of pure alcohols there may be used technical mixtures containing such alcohols for example the mixtures received by catalytic hydrogenation of sugars. These mixtures contain, mostly or in a high percentage, propane diol besides of other bivalent or polyvalent aliphatic alcohols. As to the cellulose ether carboxylic acids, especially the cellulose glycollic acids in the form of their water-soluble alkali salts are suitable, but also water-soluble salts of cellulose hydroxypropionic acids and of other cellulose hydroxyparaffin monocarboxylic acids can be used.

In some cases the effect of the greasing agents can be improved by an addition of alkali salts of lignin-sulfonic acid.

The new greasing agents show the following advantages:

(1) Far better retaining of moisture during the spinning process.
(2) They produce good adhesion between the singular fibers in the spun thread; this is particularly important when waste containing short fibers is spun.
(3) Easier processing as compared with fatty emulsions, as all auxiliary agents and devices are unnecessary.
(4) Only approximately one half of the greasing agents according to the invention is necessary as compared with the greasing agents containing fat.
(5) The greasing agents according to the invention can be washed out after spinning much more easily, than the greasing agents containing fat.

The proportion between the alcohol or ether alcohol and the cellulose ether carboxylic acid can be in the range between 3:1 and 1:3, that is to say, that one may use for example 75 parts by weight of alcohol or ether alcohol and 25 parts by weight of a salt of a cellulose ether carboxylic acid, or vice versa. If also ligninsulfonic acid is used, the sum of the weights of alcohol or ether (*a*) and cellulose ether carboxylic acid salt (*b*) can be between 75 percent to 25 percent of the total weight, the weight of the ligninsulfonic acid being 25 to 75 percent of the total weight.

The proportion between alcohol or ether alcohol and the salt of cellulose ether carboxylic acid in the greasing agents containing also ligninsulfonic acid may likewise be in the range between 3:1 and 1:3.

The following proportions have proved in many cases to be very advantageous (the parts are by weight):

		Parts
(1)	Technical propandiol	867
	Sodium salt of cellulose glycollic acid	133
(2)	Technical propandiol	517
	Sodium salt of technical ligninsulfonic acid	345
	Sodium salt of cellulose glycollic acid	138
(3)	A technical mixture of glycols made by catalytic hydrogenation of glucose at high pressure	517
	Sodium salt of technical ligninsulfonic acid	345
	Sodium salt of cellulose glycollic acid	133

The use of the greasing agents in spinning is as follows:

According to the spinning method and to the character of the fibers to be spun, 0,5% to 5% of the water-free greasing agent, calculated on the weight of the fibers, are dissolved in the necessary quantity of cold or warm water, that is approximately 4 to 10 times the amount of the water-free greasing agent. The solution is distributed finely and uniformly on the fibers either by hand or by a suitable sprinkling device. The greased batch of fibers is then mixed in a mixing-willow. In the worsted-spinning process, the solution of the greasing agent is drizzled or sprinkled on the sliver in the usual manner.

The greasing agents can be used for greasing fibers of any kind before spinning. For example, they can be used in the manufacture of army-cloth, of blankets made of wool or its substitutes, in the spinning of hair yarn, carpet yarn, in the spinning of vicugna or waste fibers using the carding process and in the worsted-spinning process for making yarns for weaving, knitting and special yarns. The application of the greasing agents is in no wise restricted, as they have no deleterious influence whatever on any fibrous materials.

GUSTAV LIETZ.

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ALIEN PROPERTY CUSTODIAN

REFLECTORS FOR HEADLIGHTS CONSISTING OF AN ELLIPSOIDAL VERTEX PART AND A PARABOLOIDAL BORDER PART

Friedrich Richard Dietrich, Munich, Germany; vested in the Alien Property Custodian

Application filed March 24, 1941

Reflectors possessing an ellipsoidal vertex part and a paraboloidal border part are known. The focuses of both parts coincide with such reflectors. The converging pencil of rays produced by the ellipsoidal vertex part is directed approximately parallel by a lens.

The present invention has for its object availing itself of such a reflecting combination without the necessity of using a light-absorbing lens.

The invention consists in the source of light lying nearest the focus of the paraboloidal border part and de-focused in relation to the focus of the ellipsoidal vertex part in direction to the vertex of same.

The attached drawing shows a form of execution of the reflector according to the invention in longitudinal section.

The reflector consists of an ellipsoidal vertex part 1 and the paraboloidal border part 2. The ellipsoidal vertex part 1 has the focus 3, whilst the paraboloidal border part 2 shows focus 4. The common plane of separtion 5 of the two parts 1 and 2 lies in front of the two focuses 3 and 4. This is, however, not absolutely necessary.

The filament of the incandescent lamp 6 lies in or near the focus 4 of the paraboloidal border part 2.

The rays emanating from the source of light are thus directed approximately parallel to the paraboloidal part 2 as drawn.

Also the filament of the incandescent lamp 6 being arranged de-focused in relation to focus 3 of the ellipsoidal vertex part 1 in the direction to the vertex of same, approximately parallel rays of light are likewise reflected by the ellipsoidal vertex part 1 which fact has for its consequence that a lens directing the rays parallel such as was required formely, may be dispensed with henceforth.

The aperture for the emanation of light of the headlight may be covered by a simple glass pane 7 which may be provided with additional diffusing channels.

The headlight is also particularly suitable for use with electric incandescent lamps and other lamps having apart from a main source of light another secondary source of light which is covered below and serves for screening. In this case the main source of light would lie again as before nearest focus 4 of the paraboloidal border part 2, whilst the secondary source of light covered below would lie near focus 3 of the ellipsoidal vertex part 1 in such a manner as to lie nearer focus 3 than focus 4.

If the focuses 3 and 4 coincided in the manner known, the de-focusing of the secondary source of light would be the same for the common focus, as the main source of light would have to lie in the common focus.

The consequence thereof would be that unless a lens directing the rays parallel be used, converging rays of light emanating from the ellipsoidal part would lie far below the border of darkness of the rays of light emanating from the paraboloidal part. As in the present case the secondary source of light lies nearer the focus of the ellipsoidal part that the focus of the paraboloidal part, it is achieved that the borders of darkness of the light of both parts of reflexion lie approximately on the same level.

Besides, a paraboloidal reflecting part of very short focal length (= distance of the focus in the vertex) may be used according to the invention. Apart from the fact that a lens is no longer required, a considerably greater utilisation of space angle is achieved as compared to the known reflecting combination with common focuses. The main source of light is thereby brought nearer the vertex of the ellipsoidal part, and by this vertex the utilisation of the space angle is increased, of course.

As compared to the known reflecting combination with common focuses a considerable diminution of the disturbance of dazzling is achieved with the headlight according to the present invention due to the fact that the secondary source of light lies near the focus of the ellipsoidal vertex part, by which, consequently, a converging pencil of rays directed downwards is produced which possesses in the middle a dark zone caused e. g. by the formation of shadow of the incandescent lamp, fitting, glass bulb etc.

Thus these converging rays of light can never produce any dazzling effect, although the reflection of the source of light is very great in the vertex. Besides an extraordinary lateral diffusion of the dimming light is caused without any additional diffusing elements on the covering glass.

A parallel direction of the rays of light cannot be achieved by aid of a reflector consisting of one single ellipsoid by de-focusing the source of light in relation to the focus, as the border zones removed from the focus would not react on the focusing.

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MAY 25, 1943.

BY A. P. C.

F. R. DIETRICH

REFLECTORS FOR HEADLIGHTS CONSISTING OF AN ELLIPSOIDAL VERTEX PART AND A PARABOLOIDAL BORDER PART

Filed March 24, 1941

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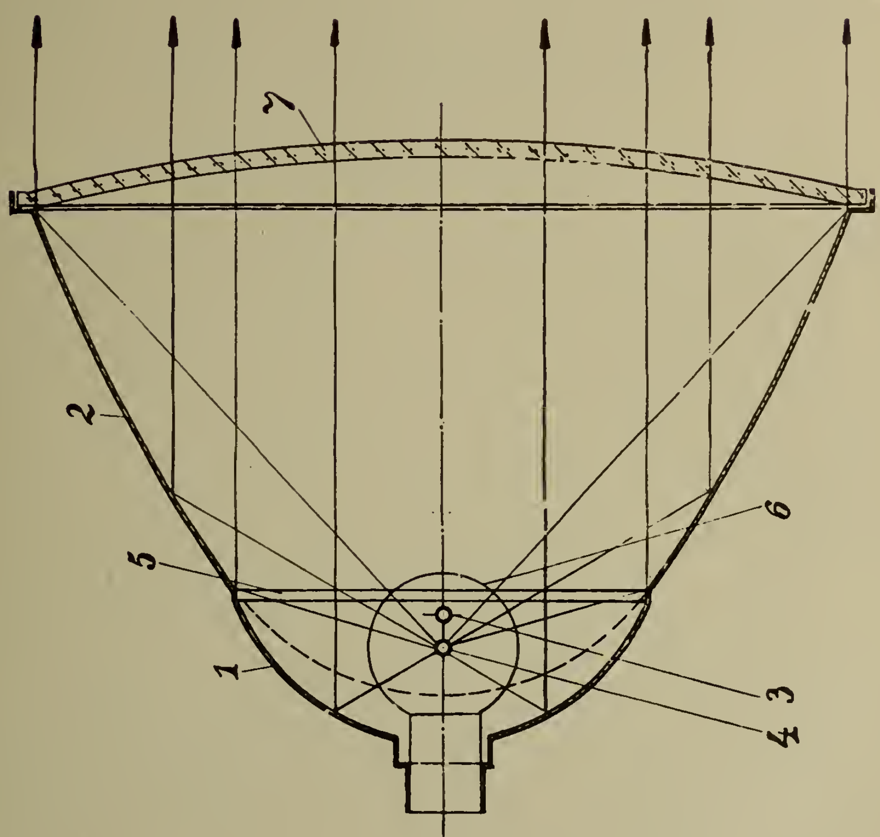

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Published May 25, 1943 Serial No. 384,869

ALIEN PROPERTY CUSTODIAN

PROCESS OF MANUFACTURING REFLECTORS, PARTICULARLY FOR HEADLIGHTS FOR VEHICLES

Friedrich Richard Dietrich, Munich, Germany; vested in the Alien Property Custodian

Application filed March 24, 1941

Reflectors for headlights of tin-foiled hollow bodies of glass are known. The reflectors are blown in a mould and tin-foiled on the outside.

As the rays emanating from the source of light and falling on the tin-foil have to penetrate first the glass reflector, it is necessary to make the hollow body of glass as thin as possible so as to avoid aberrations. Nor must such a hollow body of glass possess any strengthened borders, ruffs, collars etc. such as e. g. for the reception of lamp sockets, as in this case irregularities would result on rather a large part of the surface.

Up to now it has not been possible to dispose hollow bodies of glass of such thinness in such a manner that the incandescent lamp of the lamp socket receives a rigid position prescribed in relation to the focus.

This is taken into account by the present invention by the hollow body of glass and the protective cover possessing at the sides facing each other surfaces of the same form adjoining in an exact fit, and by the protective cover being formed besides as a carrier for the lamp socket.

The attached drawing shows a form of execution of a reflector according to the invention in longitudinal section.

The hollow body of glass **1** possessing e. g. an ellipsoidal shape is so formed as to have a thin wall, and is provided with a tin-foil **2** on the inner side.

The hollow body of glass **1** as well as the tin-foil **2** are housed in a protective cover **3** the inner side of which has the same form as the outer side of tin-foil **2**. The hollow body of glass **1** with its tin-foil **2** thus adjoins in exact fit the inner side of the protective cover **3** and is consequently completely secured against breaking in case of any occurring shocks or the like.

The hollow body of glass **1** is conveniently pressed into the interior of the protective cover **3** by springs **6** and held in position in such a manner that any removal of the adjoining surfaces of the hollow body of glass **1** and of the protective cover **3** from one another is impossible.

The protective cover **3** possesses a cylindrical lengthening piece **4** representing the carrier for the incandescent lamp **5** or its socket.

By the hollow body of glass **1** and the protective cover **3** being rigidly and indisplaceably connected with one another due to their exact fit, it is warranted that on the one hand the incandescent lamp **5** always receives the position prescribed e. g. with the filament of the lamp in the focus of the hollow body of glass, and on the other hand any change of position of the incandescent lamp **5** in relation to the hollow body of glass **1** is not possible.

FRIEDRICH RICHARD DIETRICH.

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F. R. DIETRICH
PROCESS OF MANUFACTURING REFLECTORS,
PARTICULARLY FOR HEADLIGHTS
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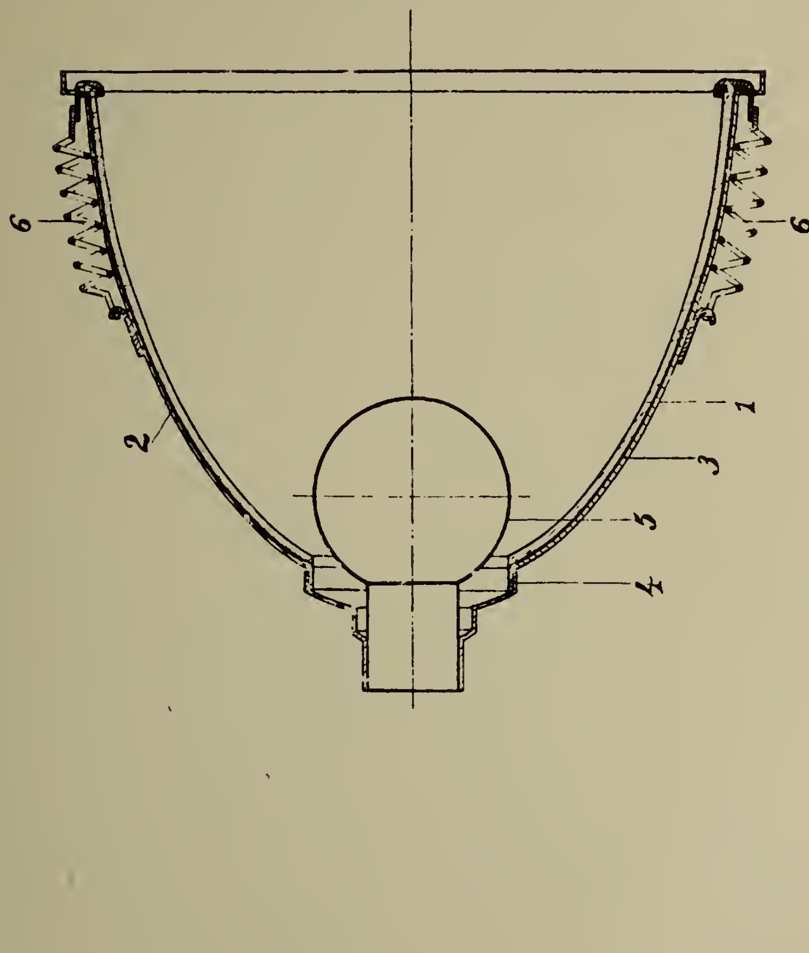

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Published May 25, 1943

Serial No. 375,071

ALIEN PROPERTY CUSTODIAN

REFRIGERATOR CABINETS

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Application filed January 18, 1941

This invention relates to improvements in refrigerator cabinets.

The insulation of cooling chambers consists in many cases of an inner casing, an outer protective casing and of the insulating material arranged therebetween. In most cases the outer protective casing has hitherto been made of sheet metal.

The invention relates more specifically to a refrigerator cabinet, the insulation of the cooling chamber thereof being exteriorly lined with a protective casing. According to the invention this outer protective casing is made of smooth sheets of papier maché which are under circumstances so bent as to attain the desired shape of the protective casing. In this manner the total weight of the refrigerator can be reduced. Since the papier maché is very resistant to external influences, such as shocks or the like its use in the manufacture of refrigerator cabinets presents considerable advantages over the metal casings hitherto employed. The casing of papier maché is secured to the refrigerator cabinet frame, for instance, by means of nails, rivets or glue. In refrigerator cabinets equipped with a refrigerating apparatus and whose motor-compressor set is arranged below the cooling chamber the two side walls and the top of the outer protective casing may be made according to the invention of one piece of papier maché which is so bent as to attain the corresponding hood shape. Also the outer lining of the refrigerator door may be made of papier maché in a similar manner as the outer casing of the refrigerator. If also the frame of the refrigerator is not made of steel but, for instance, of pressed papier maché, pressed wood dust or shavings or wood a very economical refrigerator cabinet may be manufactured in which the metal is replaced by another material which is very suitable owing to its small specific weight and to the fact that it may be machined for the purpose in question in a much easier manner.

In the accompanying drawings are shown some forms of the invention in diagrammatic form.

Figs. 1 and 2 show perspective views of the front and rear side of the refrigerator cabinet frame. The cabinet frame consists of the door case 1 and a rear frame part 2. The parts 1 and 2 form at the same time the feet for the refrigerator cabinet and are combined with the cross timbers 3 to form a common refrigerator cabinet frame. This refrigerator cabinet frame may, for instance, be made of pressed papier maché, pressed wood dust or shavings or of wood. As an outer lining for the refrigerator cabinet frame a hood 4 of papier maché of one piece is employed in the embodiment as shown in Figs. 1 and 2, which forms the two sides and the top of the outer lining. The hood of papier maché is flanged as indicated at 5 and secured to the frame of the refrigerator cabinet by means of nails 6. Also the outer lining 7 of the rear wall shown in Fig. 2 consists of papier maché.

Figs. 3 and 4 show a perspective view of the door frame 8 and a sectional view thereof and of the outer protective casing 9 secured thereto. This protective casing consists likewise of papier maché which is given the corresponding shape, the protective casing being secured to the door case also by means of nails 6.

The hood of papier maché as employed in the embodiment according to Figs. 1 and 2 has as practical tests have shown such a strength that the cross timbers 3 may be entirely dispensed with.

Figs. 5 and 6 show another embodiment of the invention. In this case the refrigerator cabinet is provided with a relatively low support 11. The side walls and the top of the cabinet consist of a correspondingly bent portion of papier maché 12 which as shown in Fig. 6 is riveted to the two ends. In this instance, the papier maché is also secured to the front frame part and rear door case by means of nails 14. The rear door case 15 is shown in Fig. 6. 16 denotes a cross bar to which the inner refrigerator casing 17 is secured with the aid of straps 18. Corresponding straps 19 serve to secure the upper part of the inner casing 17 to the door case 15. In this construction the machine department 20 is arranged beneath the cooling chamber and is closed by the wall 12 of papier maché. The machine department is closed at the front side by means of a flap 21. 22 denotes the refrigerator door. The latter is so dimensioned that it completely covers the parts of the insulating wall facing the cabinet door case.

In Figs. 7 and 8 is shown another modification of a refrigerator door, in which similar numerals denote similar parts of Figs. 3 and 4. To strengthen the frame of the door and to maintain the outer lining cambered a holder formed of the braces 22 and 23 is arranged in the door frame.

A further embodiment of the invention is shown in Figs. 9 and 10 which are perspective views of the front and rear side of a refrigerator cabinet and in which similar numerals of reference denote corresponding parts of Figs. 5 and 6. The refrigerator frame consists in this case of a

door case 26 and of a rear frame part 27. The parts 26 and 27 are secured to each other by means of an outer hood 24 consisting of papier maché. Also in this case the lining 24 of papier maché is sufficient to brace the two parts 26 and 27. The lower part of the cabinet is provided with a profiled ledge 25. This ledge may, of course, be made without the off-set portion shown. The inner casing 17 of the refrigerator is secured in this embodiment only to the door case 26. This method of fastening is sufficient, particularly for small refrigerators so that the straps 18 shown in Fig. 6 may be dispensed with.

The parier maché used according to the invention has preferably a pressed surface as the cardboard used in connection with the manufacture of suit cases. The saving in weight obtained according to the invention amounts to about 50% as compared to the weight of such refrigerator cabinets provided with an outer sheet metal lining. The manufacture of refrigerator cabinets may also be rendered considerably more economical according to the invention by directly purchasing of the supplier of the cardboard, varnished cardboard of the corresponding color for the outer lining so that it is not necessary to treat the outer surface of the refrigerator cabinet consisting of papier maché.

RUDOLF HINTZE.

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MAY 25, 1943.
BY A. P. C.

R. HINTZE
REFRIGERATOR CABINETS
Filed Jan. 18, 1941

Serial No.
375,071
3 Sheets-Sheet 1

Fig. 1

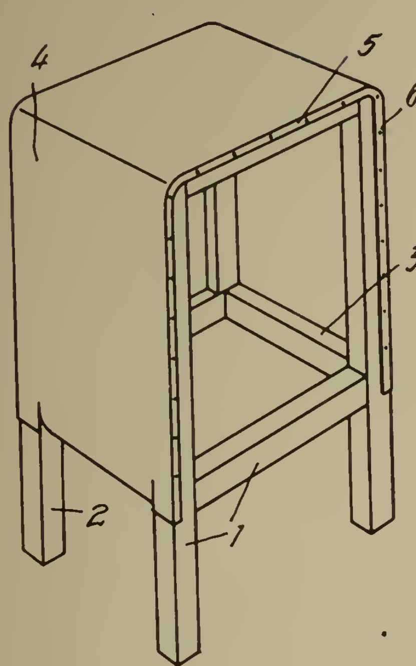


Fig. 2

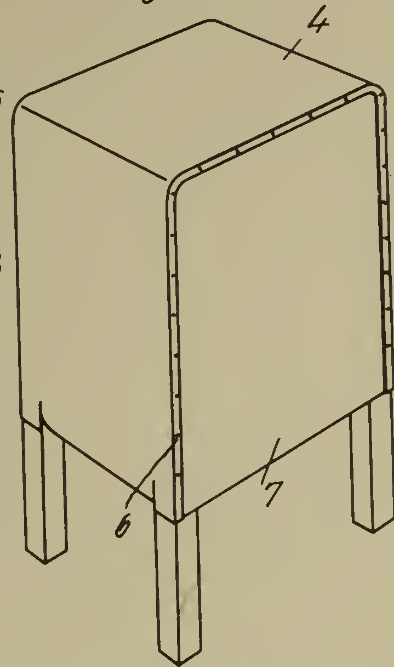


Fig. 3

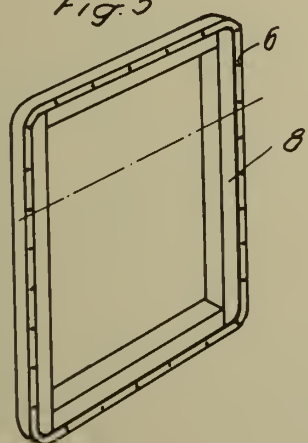
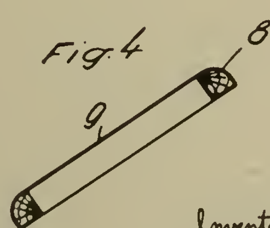


Fig. 4



Inventor
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Fig. 5

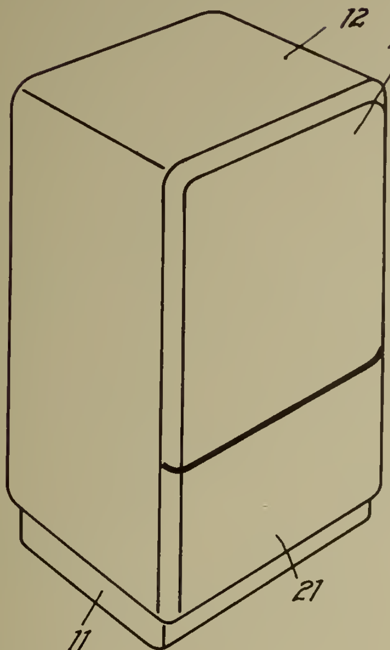


Fig. 6

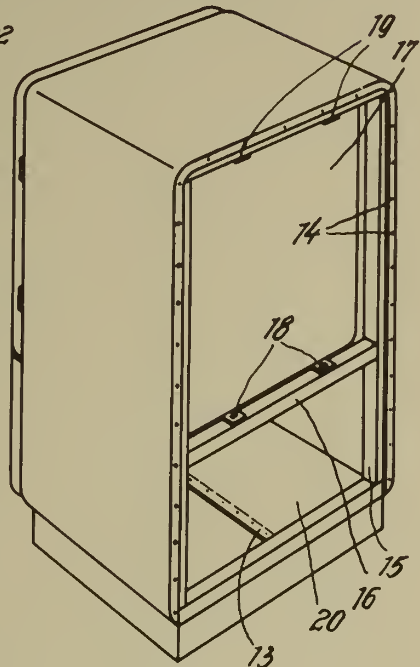


Fig. 7

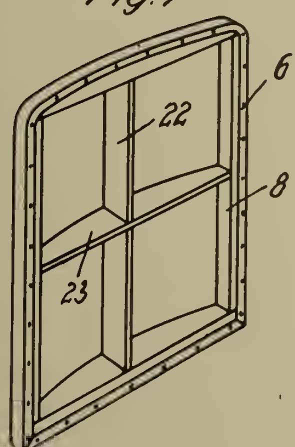
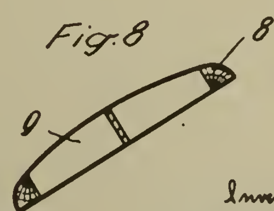


Fig. 8



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REFRIGERATOR CABINETS

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Fig. 9

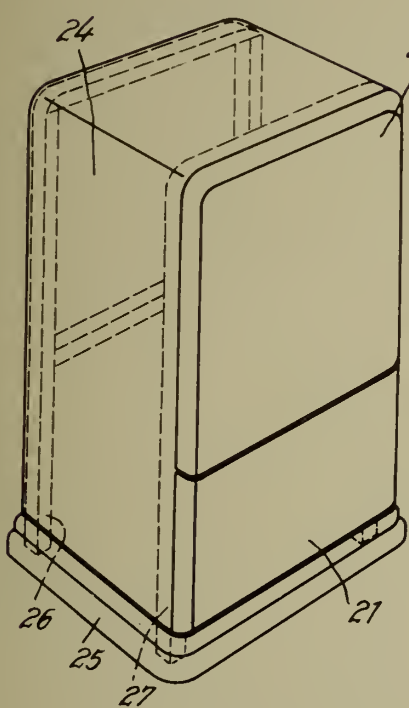
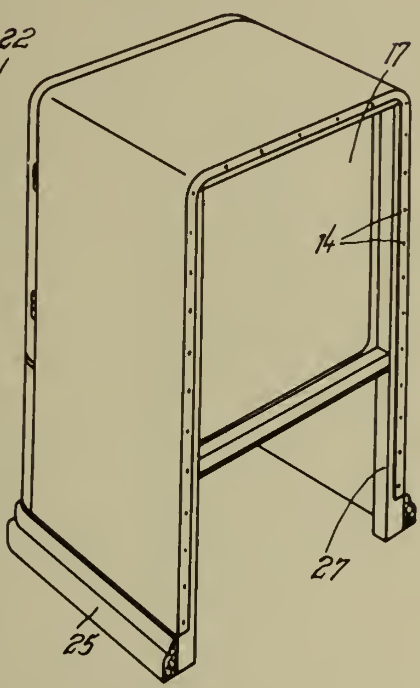


Fig. 10



Inventor
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Published May 25, 1943

Serial No. 385,115

ALIEN PROPERTY CUSTODIAN

ELASTIC SUPPORT OF DISCS FOR RADIAL FLOW ROTARY MACHINES

Ulrich Meininghaus, Muelheim-Ruhr, Germany; vested in the Alien Property Custodian

Application filed March 25, 1941

The present invention relates to the construction of means for elastically supporting the discs of radial flow rotary machines, and especially the discs carrying blades or labyrinth packing of radial flow steam and gas turbines.

It is the general object of the invention to provide an elastic and tight joint between such discs and the supporting machine part, preferably the housing, which joint is capable to withstand a high pressure difference prevailing between the both sides of the disc, and in particular a joint which avoids an unduly axial length and parts projecting in axial direction from the space otherwise occupied by the disc body. Other, more specific objects of the invention will appear from the detailed description hereinafter.

The accompanying drawings illustrate by way of example steam turbine discs according to the invention. Fig. 1 shows a vertical section through the upper half of such a disc with the elastic joint which is assembled in the direction of the axial thrust exerted on the disc by the steam pressure, Fig. 2 a similar section with the opposite direction of assembling. Fig. 3 gives a vertical section through the whole turbine.

In Fig. 1 the disc is split in two halves **1** and **1***a* carrying the blades **2** and **3**. Annular flanges **4** and **4***a* are arranged at the outer rims of the disc halves such flanges being clamped between the radially extended surfaces **5** and **6**. The clamped surfaces are in the radial direction smaller than a quarter of an inch and thus allow not only for free radial movement of the disc halves, but also for any inclination which the lateral pressure on the disc halves may cause. The radially extended surfaces **5** and **6** are arranged on a special flange **7** and a plate **8** screwed on it. The whole assembly fastened to flange **7** is mounted in the direction of the lateral pressure exerted on the disc halves. The direction is given in Fig. 1 by the arrow. The flange **7** itself is bolted to the housing **9** from the other side.

At **10**, **11**, **12** and **13** thin walled rings **14** and **15** of semicircular cross section are fastened with their rims to the disc halves **1**, **1***a* and the flange **7** by means of caulking wires. In this way I obtain an absolute tight connection between the disc halves and the flange **7**. Neither high pressure nor high temperature difference will ever cause the slightest leakage at the caulked joints. By reason of the small thickness of the caulked in ends of the rings **14** and **15** no appreciable change in thickness of the spanned in ends can occur due to expansion or contraction by change in temperature or pressure. Such difficulties as known with screwed on or bolted on flanges of considerable thickness are impossible with this joint. Instead of fastening by means of caulking in a wire the material of the ring end or of the rim to which the ring end is to be fastened may be expanded by a special tool thus increasing the diameter and pressing the parts tightly against an other in a well known manner.

By giving the cross section of the thinwalled elastic rings **14** and **15** a semicircular shape I obtain the strength of these rings required to withstand even a high difference in pressure between both sides of the rings. The radius of the semicircle of the cross section I make comparatively small as compared with the mean radius of the ring itself. It is well known that any pressure difference exerted on a cylinder will cause a circumferential stress which is greater than the pressure difference in the ratio of the mean radius of the cylinder to the thickness of the wall. Would for example the wall of the cylinder amount to one eighth of an inch and the mean diameter to 50 inches, then a pressure difference of 300 lbs./sq. in. would cause a circumferential stress of

$$\frac{50\times300}{2\times\frac{1}{8}}=60{,}000\text{ lbs/sq. in.}$$

Stresses of this magnitude cannot safely be admitted in addition to the bending stresses which are unavoidable. On the other side, if the semicircular cross section of the circumference of the elastic ring has i. e. a diameter of one inch the circumferential stress at the same pressure difference will amount to

$$\frac{1\times300}{2\times\frac{1}{8}}=1200\text{ lbs/sq. in.}$$

only. It it true that this stress when referred to the whole ring is running rather in radial planes, but it prevents with absolute safety the occurrence of the above calculated much higher circumferential stress.

As far as the elasticity of the semicircular cross section of the ring should be deemed insufficient I limit the required amount of elasticity i. e. by shrinking the rims **4** or **4***a* of the discs on the inner rims of the rings **14** and **15**, or by shrinking the outer rims of the rings **14** and **15** on the flange **7**, or vice versa. I gain this possibility of shrinking by having both legs of the semicircular cross section of the ring pointing in about axial direction at the lines of junction with the ring ends **10**, **11**, **12** and **13** which connect the ring to the disc halves **1** and **1***a* or the flange **7**

rigidly. I secure with this arrangement on account of which the semicircle of the cross section opens in axial direction also a better distribution of the bending stresses which occur when the span between the two legs of the semicircle of the cross section is diminished or increased by a difference in expansion of the disc halves 1 or 1*a* and the flange 7. By changing the span of the axially pointing legs circumferential stresses arise in these legs which effect an improved distribution of the bending stresses and prevent a local overstressing. These circumferential stresses prevent in addition any buckling of the thin legs of the elastic rings 14 and 15.

To relieve the thin walled elastic rings 14 and 15 from the transfer of the torque which is exerted by the steam on the blading 2 and 3 projections 16 or keys 17 are provided which fit into corresponding grooves. These projections or keys may at the same time keep the disc halves 1 and 1*a* in their central position should the thin walled elastic rings 14 and 15 break for some reason.

By splitting the disc in two halves 1 and 1*a* and fastening each half by a separate elastic ring 14 and 15 to the flange 7 I make it possible to admit or lead off steam to or from the inner rim between the blading 2 and 3 through the bore 18 in the flange 17. All joints are absolutely tight at all changes in temperature and pressure and the admitted or lead off steam flows in equal distribution over the rear surfaces of the disc halves thus securing an equal change in temperature of the disc material.

Fig. 2 shows a similar arrangement as Fig. 1. The same reference characters apply to this figure. In Fig. 2 the disc halves 1 and 1*a* are together with the elastic rings 14 and 15 moved into the housing against the direction of the thrust exerted by the steam pressure on the discs which direction is given by the arrow in Fig. 2. This way of mounting obviates any flange at the high pressure side of the turbine. The elastic rings 14 and 15 I fasten with their outer rims directly into the housing 9. No steam tight joint between the flange 7 and the housing 9 is required as was the case with the arrangement of Fig. 1. The bore 18 does not run through flange 7 any more, but through the housing 9 only. It is thus possible to form the flange 7 with a bajonet instead of bolting it to the housing 9. All the difficulties which so easily arise with heavily loaded screwed on flanges are avoided. Much space is saved in this way and the outside diameter of the housing considerably reduced. To make sure that the axial thrust exerted by the steam pressure does not loosen the caulking connection at 12 and 13 an annular projection 19 is provided at the elastic ring 14 and an additional ring 20 pressed against the joint at 13 by means of screws 21. As any axial movement of the inner legs of the elastic rings 14 and 15 exerts a rolling action on the semicircular cross section of these rings winding the cross section like the spring of a watch and as also the plate 8 is elastic the bajonet ring 7 is easily brought into place. Making use of the high elasticity of a ring with a circumference of semicircular cross section in the direction in which the legs of the semicircle point is a special feature of my invention.

The steam turbine which Fig. 3 shows in section makes use of the present invention for all stationary discs. The shaft of the turbine appears at 31 and carries the wheels 32, 33 and 34 with the blades 35, 36, 37 and 38. The discs 39 and 40 hold the stationary blades 41, 42, 43 and 44. The fastening of the disc 39 corresponds with Fig. 2, the fastening of the disc 40 is similarly arranged. The steam enters through the nozzles 45, passes the impulse blade row 46 and then the reaction blading 41, 42, 43 and 44. The axial thrust of the reaction blading is balanced by the labyrinth disc 47 and 48. 49 represents the housing of the turbine.

Obviously, my invention is not restricted to rotary machines of the specified form illustrated, but for example may be used with discs along which the working medium flows in the same direction on both sides. Or only one side of the wheel may carry blades, the other side for instance labyrinth packing.

ULRICH MEININGHAUS.

PUBLISHED

MAY 25, 1943.

BY A. P. C.

U. MEININGHAUS

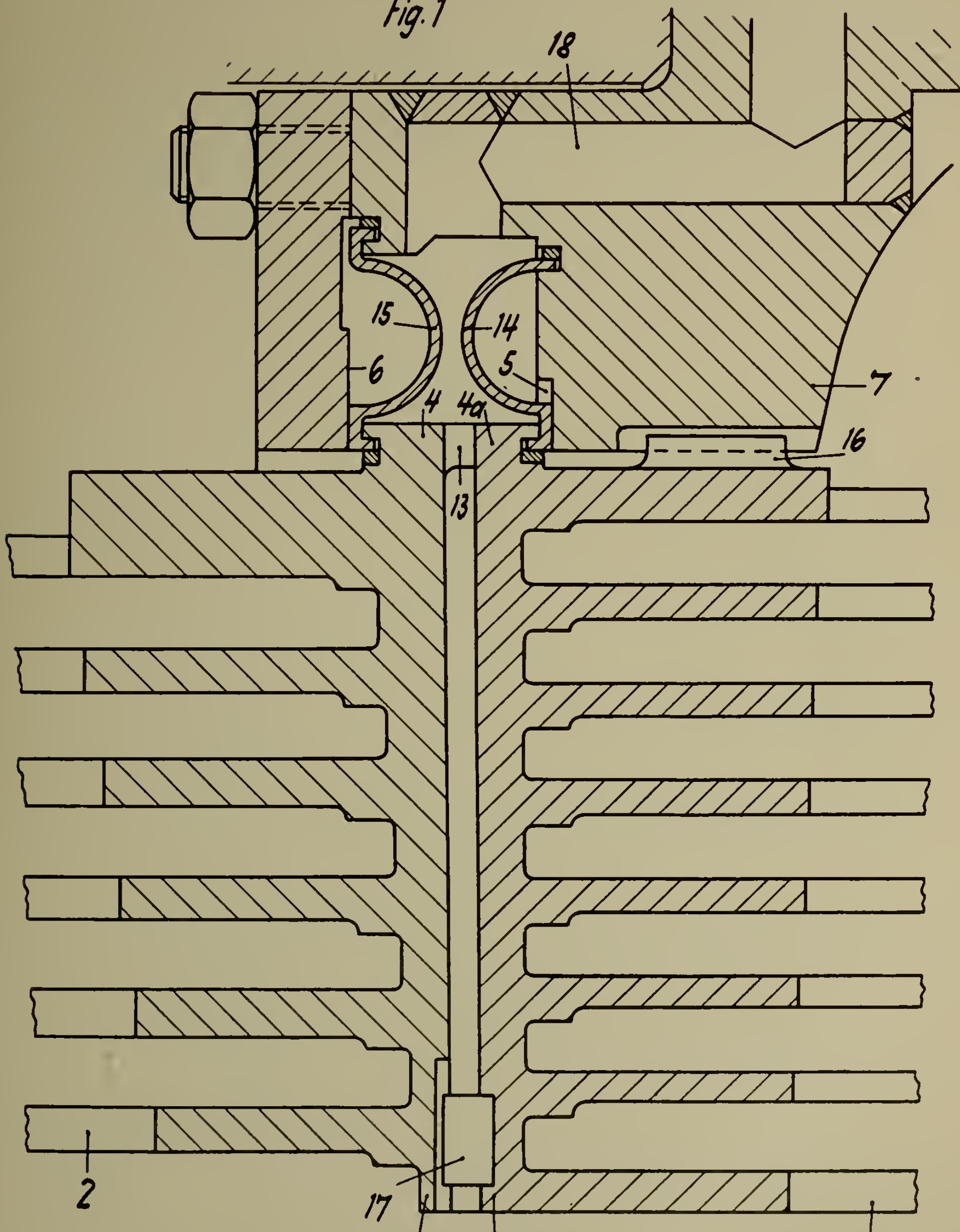
ELASTIC SUPPORT OF DISCS FOR RADIAL FLOW ROTARY MACHINES

Filed March 25, 1941

Serial No. 385,115

3 Sheets-Sheet 1

Fig. 1



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U. MEININGHAUS
ELASTIC SUPPORT OF DISCS FOR
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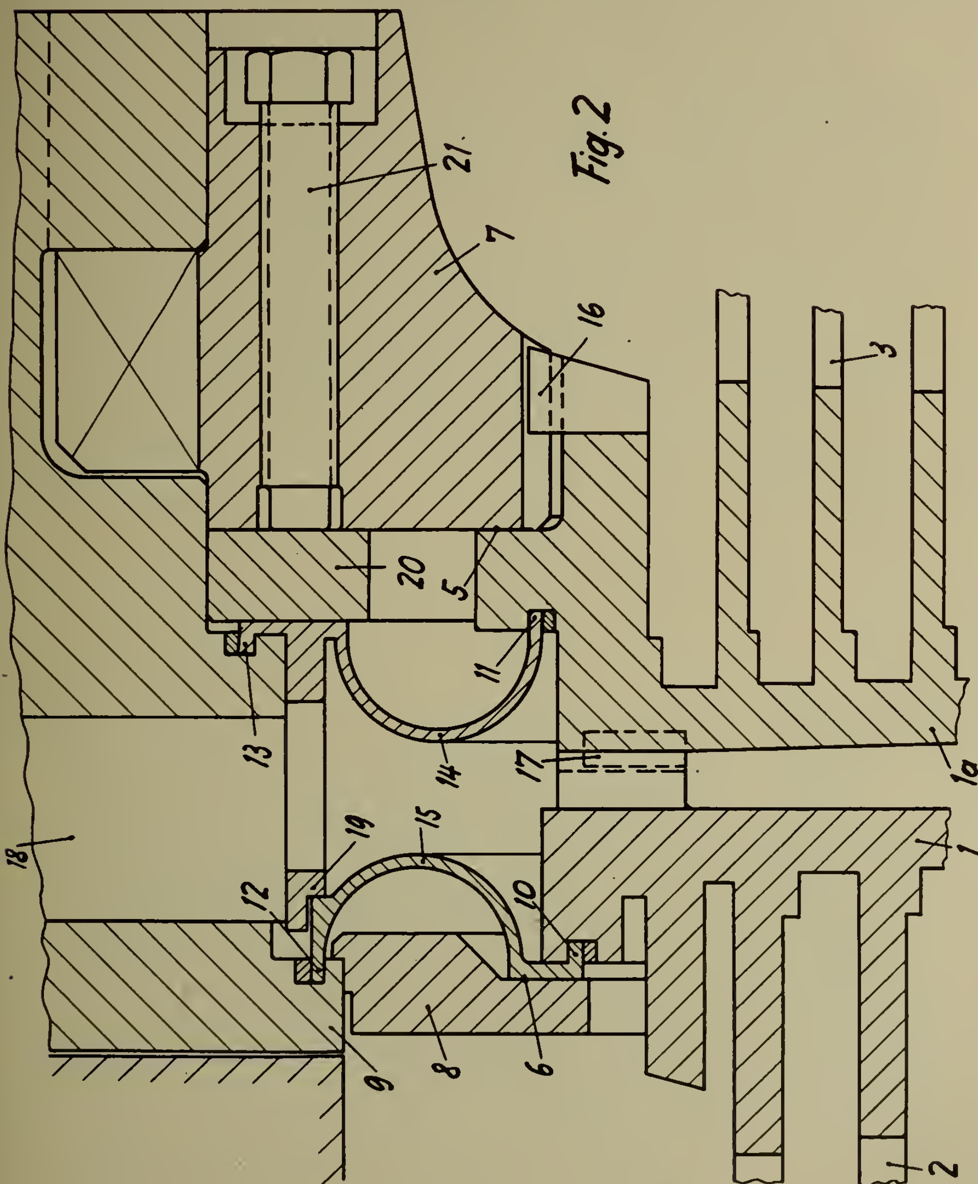

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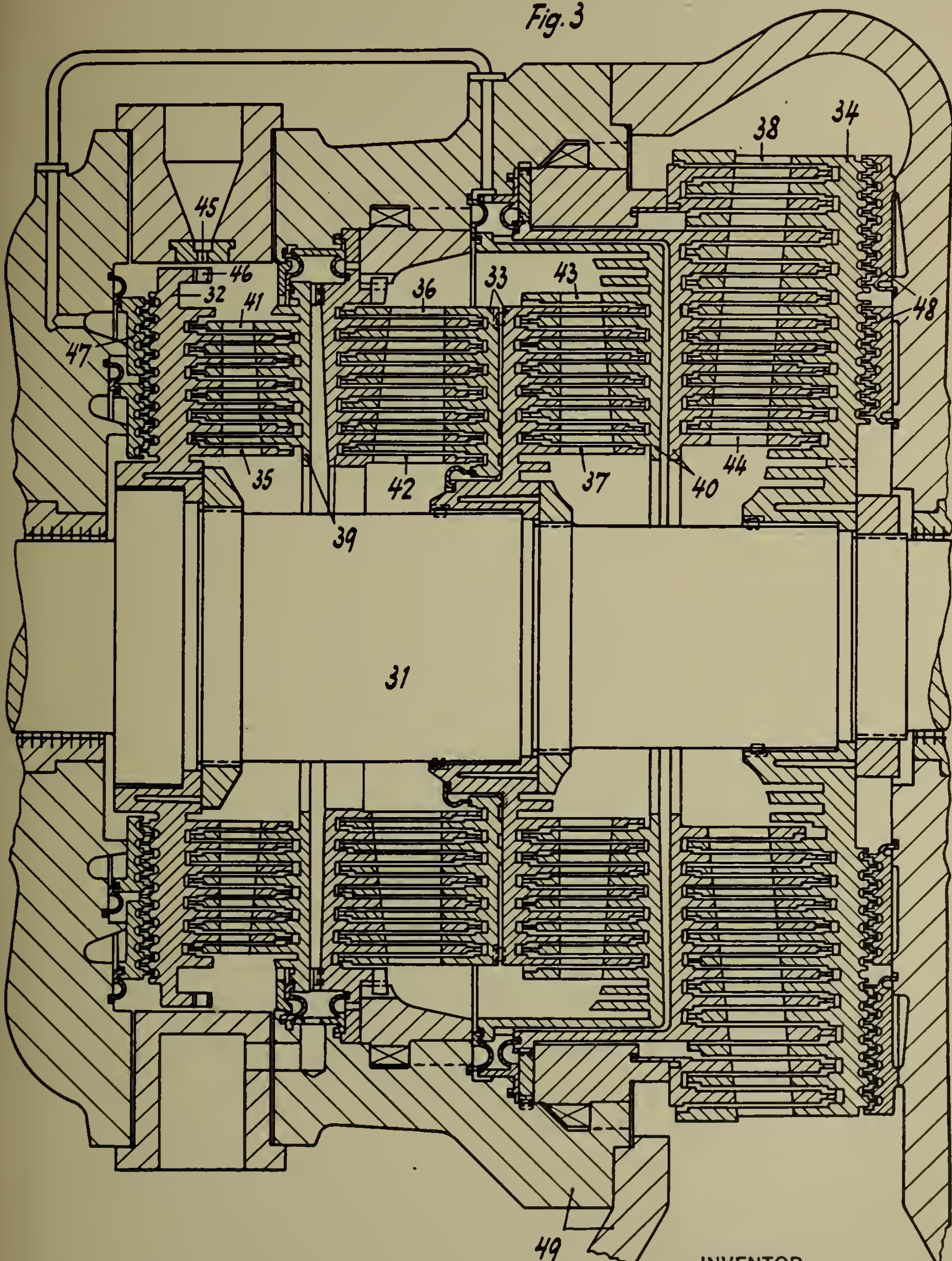
Fig. 3



INVENTOR

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Lackenbach + Hirschman

ATTORNEYS

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ALIEN PROPERTY CUSTODIAN

BLADE FASTENING FOR GAS TURBINES

Alfred Schütte, Augsburg, Germany; vested in the Alien Property Custodian

Application filed March 26, 1941

This invention relates to a blade fastening for gas turbines.

In gas turbines, which are operated at very high gas temperatures, blades of ceramic masses are used, since metallic materials capable of withstanding the stresses due to the high temperatures are not available. The ceramic materials used for this purpose must moreover be carefully selected, because not all of them are suited for the high tensile stresses involved. Furthermore, as ceramic materials cannot be treated like steel to avoid interior shrinkholes and cavities, considerable difficulties present themselves when larger structures, such as entire turbine rotors with the blades, have to be manufactured, which possess the necessary strength properties. According to a known method the blades only are made from ceramic materials and provided with a so-called T-head base by means of which they are fixed between two discs produced from steel of high creep strength. In this construction the blades engage with two shoulders corresponding recesses of the discs so that the shoulders are subjected to bending stresses by centrifugal force. Furthermore, at the points of transition of the shoulders notch effects appear which should be absolutely avoided, since ceramic materials are particularly sensitive to notching and bending stresses.

According to the invention the disadvantages connected with the known constructions are eliminated by replacing the T-head base of the shoulders by a cone which abuts against corresponding conical surfaces of the steel discs, so that bending stresses are avoided and the base of the blades is subjected only to compressive stress due to the pressure of the steel discs. As the safe compressive stress in ceramic materials is extraordinarily high, the stress conditions of a blade according to the invention are quite favorable.

The invention is illustrated by way of example in the accompanying drawing, in which

Figure 1 is a longitudinal section of a rotor of known type and

Fig. 2, a longitudinal section of a rotor according to the invention.

In the drawing 1 designates the blades of ceramic material; 2, the lateral fixing disc of steel possessing high creep strength; and 3, a tension bolt or stay pressing the disc 2 against the blades 1. In the construction of the old art shown in Fig. 1 the blades 1 engage with two shoulders 4 in corresponding recesses of the discs 2, and the shoulders 4 are thus subjected to bending stresses due to centrifugal force at the faces 5. Notch effects appear at 6.

In Fig. 2 the contact faces 7 between the discs 2 and the blades 1 have conical shape, so that merely compressive stresses act on the blades 1 during application of the discs 2 as well as owing to centrifugal force.

ALFRED SCHÜTTE.

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A. SCHÜTTE
BLADE FASTENING FOR GAS TURBINES
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385,333

Fig. 1

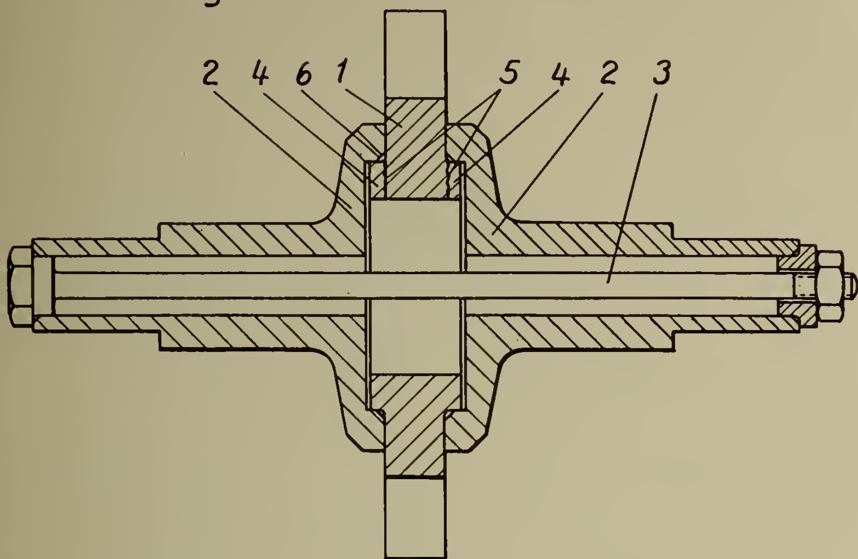
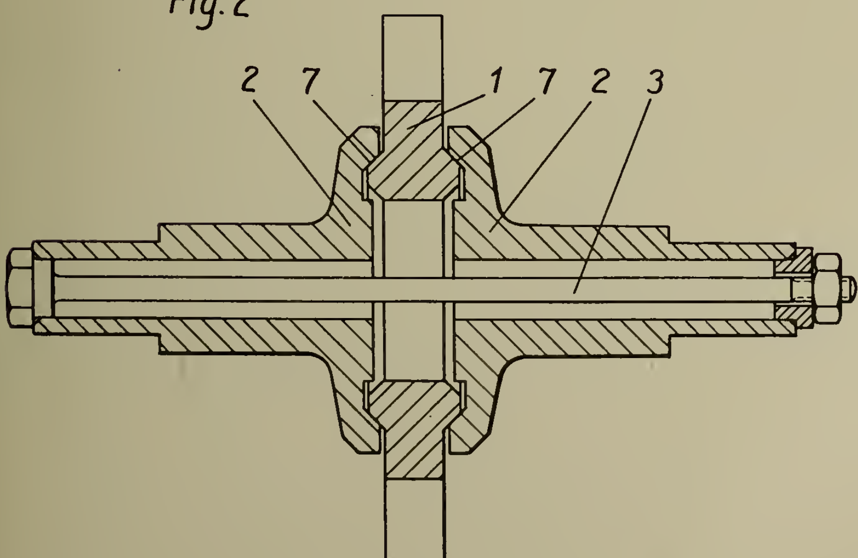


Fig. 2



Inventor
Alfred Schütte

By Maréchal & Noe
Attorney

Published May 25, 1943 Serial No. 385,334

ALIEN PROPERTY CUSTODIAN

BLADED GAS TURBINE ROTOR MADE OF CERAMIC MATERIALS

Alfred Schütte, Augsburg, Germany; vested in the Alien Property Custodian

Application filed March 26, 1941

This invention relates to a bladed gas turbine rotor made of ceramic materials.

The successful operation of a gas turbine requires high gas temperatures, and even the best steels of high creep strength fail to satisfy at temperatures exceeding, say, 700° C. It has therefore been proposed to make the parts exposed to high gas temperatures from ceramic materials possessing sufficient strength at high temperatures, but such an arrangement involves numerous difficulties. It is possible of course to make the rotor integral with the blades in a reaction turbine having few winglike blades, but if many heavily curved blades are required in a different type of turbine the application of this method will cause a lot of trouble. In particular, it is hardly possible subsequently to finish the blades of such a wheel. It has further been suggested separately to produce the rotor and the blades fitted with a T-head or a "Laval" base and then to insert the latter in the rotor. A T-head, however, subjects the portion of the rotor embracing the base of the blade to considerable bending stresses, which should be avoided in ceramic materials, and the fastening of the closing piece is, moreover, quite difficult. Blades having a "Laval" base require, on the other hand, insertion under tension, i. e. a close or force fit, impossible in case of ceramic materials.

According to the invention these difficulties are overcome by separately manufacturing the blades having a "Laval" or similar base from ceramic materials and choosing the permissible variations of the base and of the corresponding grooves in the rotor so that the blades are inserted with suction in the grooves of the rotor and are burned thereto with the aid of a glaze which is stable up to temperatures slightly exceeding the gas temperature in the turbine.

One form of the invention is illustrated by way of example in the accompanying drawing, in which

Figure 1 is a partial longitudinal section of a rotor according to the invention, and

Fig. 2 is a partial cross section thereof.

In a rotor **1** having shaft ends **2** finished blades **3** are inserted and secured therein by means of a glaze burnt upon the fully assembled wheel.

ALFRED SCHÜTTE.

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BY A. P. C.

A. SCHÜTTE
BLADED GAS TURBINE ROTOR MADE
OF CERAMIC MATERIALS
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Fig. 1

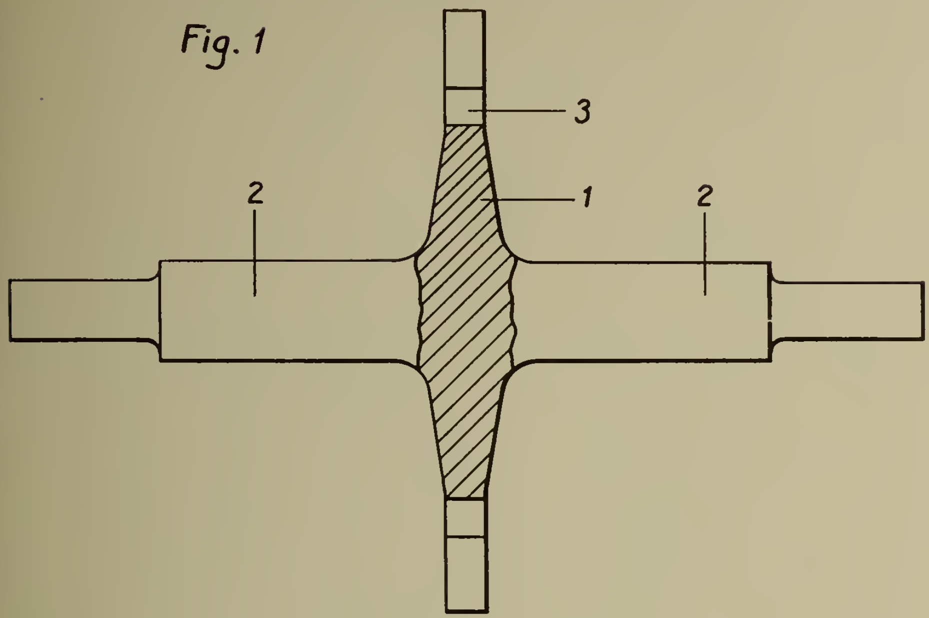
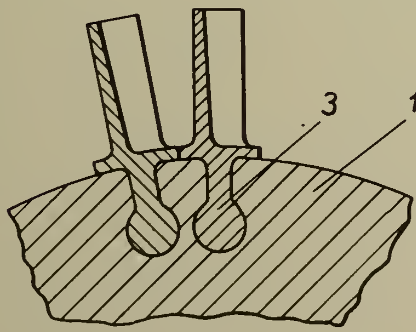


Fig. 2



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ALIEN PROPERTY CUSTODIAN

CATHODE RAY TUBES

Maximilian Messner and Erich Schantl, Berlin, Germany; vested in the Alien Property Custodian

Application filed April 1, 1941

In cathode ray tubes or so-called Braun tubes the distance between the emissive layer and the control electrode should be the same at any temperature, in order to render the characteristic control line invariable in position. In many cases the cathode is a metal cylinder in which a heating coil is arranged and which at its front end carries the emissive layer. This cylinder expands in accordance with the temperature the cathode acquires. The practice has been to fix the cylinder at the end remote from the emissive layer. As a result, with rising temperature the cylinder expands toward the control electrode and thus brings the emissive layer nearer to this electrode. Therefore, it has been proposed to mount the cylinder by means of a device arranged to withdraw from the control electrode whenever the temperature rises. Such device, however, is complicated and its operation does not give the desired result.

The present invention therefore proposes that the cathode cylinder, that is, the metal cylinder which at one end carries the emissive layer, be held in position with the aid of supporting means by which it is engaged at a zone located in close proximity of the emissive layer. In this way, the cylinder is prevented from expanding toward the control electrode. It will expand instead in the opposite direction, that is, in the direction of its free end.

The accompanying drawing is a fragmentary sectional view of a cathode ray tube as provided by the invention.

The emissive layer E is fitted to one end of a tubular metal cylinder Z, which is closed at this end while its other end is open. Fixed within this cylinder is a heating coil H, inserted through the open end thereof. Cylinder Z is pressed into a ceramic disc T. A disc-shaped control electrode S is spaced from the layer E by a desired distance afforded by an insulating ring R that rests against disc T or is formed integral therewith. The parts T, R, S may be held together by a tubular body D of moulded insulating material. In addition, a suitable clamping device, not shown for simplicity, may be used to press the parts T, R, S together.

The disc T carrying the cylinder Z is fitted to it at a zone adjacent to the emissive layer E. The cylinder thus has a portion that projects from disc T and on the side thereof remote from the layer E. This portion is free to expand during the operation of the cathode ray tube, while the portion on which the disc T is seated does not expand and hence does not vary the distance between layer E and electrode S.

The disc T also carries metal rods N_1, N_2 and an insulating bridge B fastened to these rods. In the case shown by way of example the rods N_1, N_2 are hollow, being fixed to disc T in the manner of tubular rivets. The structure N_1, N_2, B serves to join the three connecting wires of the cathode arrangement H. Z to three sufficiently strong connectors V and thereby to protect them from injury. The connectors V may be wires or tapes and are secured in the stem of the bulb C in a well-known manner not represented here.

It will be seen that the arrangement Z, E, H, T, R, D, N_1, N_2, B may be added as a whole to the electrode system of a cathode ray tube, a guide G for the cathode structure being arranged in the bulb C. The cathode structure is hence exchangeable, and as it is a separate body, the act of arranging the cathode structure may be the last step in the manufacture of such a tube, namely, a step effected with the avoidance of an unduly high sealing temperature.

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ERICH SCHANTL.

PUBLISHED

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BY A. P. C.

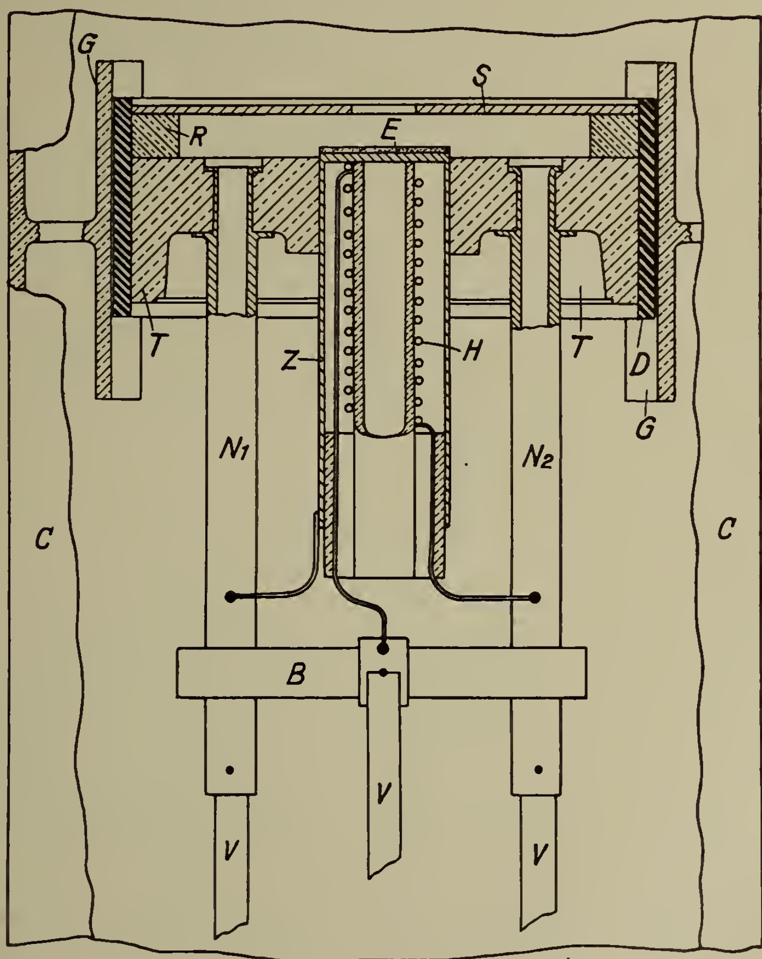
M. MESSNER ET AL

CATHODE RAY TUBES

Filed April 1, 1941

Serial No.

386,266



Inventors:

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Erich Schantl
by [signature]
Atty

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ALIEN PROPERTY CUSTODIAN

TUBE COUPLINGS

Hans Kreidel, Wiesbaden, Germany; vested in the Alien Property Custodian

Application filed April 3, 1941

The invention relates to a tube or pipe coupling according to my co-pending application, Serial No. 278,473, of June 10, 1939, referring to conically flared tube ends.

It is the object of the invention to provide a tube coupling in which the flared tube end has a cylindrical extremity which affords an additional stiffening.

A further feature is the provision of a tube coupling which is more resistant to mechanical stresses, as the distance of the contact face of the tube end face to be sealed from the point of application of the gripping edge at the outer surface of the tube may be made larger.

A further advantage is the provision of a tube coupling in which—although the tube is given but a slight expansion that should not be essentially greatr than the wall thickness of the tube—the conically flared portion may be made shorter and thus steeper. In this manner the feed of the gripping ring during the tightening operation will be reduced so that it will be impossible for inaccuracies of the tube surface to make themselves felt any longer to an appreciable extent.

Other objects of the invention will appear from the following description, reference being had to the accompanying drawings, in which:

Fig. 1 is a quarter sectional view of a coupling connection in tightened condition having a shoulder stepped at right angles and a gasket in the coupling member;

Fig. 2 is a view similar to Fig. 1, showing a tube coupling having a relieved shoulder and gripping ring stepped on both sides, no separate gasket being provided;

Fig. 3 is a quarter sectional view of a tightened tube coupling in which the ends of the tubes to be sealed abut against each other and the gripping rings are acted upon by two tightening means to be threaded into each other;

Fig. 4 is a quarter sectional view of a flanged coupling, and

Fig. 5 is a sectional view of a connecting flange with a split gripping ring, the bore of flange being greater than the diameter of the greatest external diameter of the flared tube end.

According to my invention the conically flared tube terminates cylindrically in the diameter of the expansion. The thus obtained stepped expansion forms an appreciable stiffening of the tube end to be sealed to the effect that the danger of a subsequent deflection or deformation thereof during the tightening operation will be considerably diminished even in the case of softer and thin-walled tubes. Since the cylindrical extremity of the tube end may be made of any desired length, the tube may be stepped off on a longer way, thus the risk of collapsing will be considerably reduced if the pipe line is subjected to bending stresses or shaking movements.

d denotes the tube and d^1 the flared portion thereof in all of the figures. d^2 is the tube end terminating cylindrically according to the invention in the diameter of the greatest expansion. The amount of expansion is only such that the internal diameter of the cylindrical extremity d^2 is suitably smaller than the external diameter of the unflared portion of the tube.

Lest the construction of the coupling connection becomes excessively long, the shoulder is incorporated in the coupling member *a*. In Fig. 1 showing a coupling such as may be used particularly for connecting comparatively hard, rigid tubes, the shoulder extends perpendicularly to the axis of the tube, being at the same time used for accommodating a separate gasket *h* of conveniently softer material. The cap nut *c* has a cylindrical outer surface and is at the front sides provided with grooves c^1 adapted to be engaged by the wrench. *e* is the actual gripping ring.

For the connection of softer tubes, e. g., copper tubes, or the like, use is preferably made of a coupling, such as shown in Fig. 2. Here, the shoulder provided in the coupling member *a* for the end face of tube to be sealed is slightly relieved. The tube which is axially stressed by the rectilinearly moved gripping ring *e* on tightening the coupling is forced by its end into the relieved portion of the shoulder, whereby a particularly efficacious sealing rendering the use of a separate gasket superfluous will be obtained and, at the same time, the tube will be held from rotation with the coupling being tightened. In this embodiment the gripping ring *e* is grooved at the front side so as to prevent the tube stock upset by clamping the gripping edge from being forced outwardly. In this manner the gripping ring is subjected to a positive limitation of its feed by the stock collecting in, and filling up, the annular groove; this might be of importance when using tubes of softer material, e. g., to prevent the gripping edges from penetrating the tube stock to an excessive depth. In order to be able to utilize the gripping ring *e* on either side and to preclude defective assemblies likely to occur when inserting the gripping ring the wrong way, the annular groove is here provided on both end faces of the ring. Unlike the one-piece cap nut *c* in the embodiment shown in

Fig. 1, the shoulder for the gripping ring is here made a separate ring with external thread screwed into the cap nut c in order to save material.

The tube coupling shown in Fig. 3 is adapted to connect two tubes the faces of the flared ends of which abut direct against each other. In this case it is not necessary to use a coupling member having a separate shoulder. The co-action of the threaded members c and o engaging a gripping ring at a time and moving towards each other on being tightened will be readily seen from the illustration.

Also in the case of the flanged coupling shown in Fig. 4 the flared tube ends to be sealed are facing each other, but here is interposed a separate ring i the external edges of which project on either side and are used for securing the inserted gaskets h^1 and h^2. k are the bolts holding the flanges l and m together. The left hand flange l has an inner edge acting direct as hard gripping edge, whereas in the case of the right hand flange m the gripping edge forms part of a separate inserted ring m^1 of greater hardness which is sunk into a groove of the actual bore of flange.

The type of flange shown in Fig. 6 is adapted to be subsequently slipped over the flared tube end d^1, d^2 indicated by the dotted lines. The bore of this flange n has an internal diameter greater than the external diameter of the flared tube end d^1, d^2. In this case the actual gripping ring must be of the split type. The latter is here denoted as at e^1 and, like the flange n, will be subsequently slipped over the flared tube end or ends, then compressed and forced into the annular groove of the bore of flange.

HANS KREIDEL.

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H. KREIDEL
TUBE COUPLINGS
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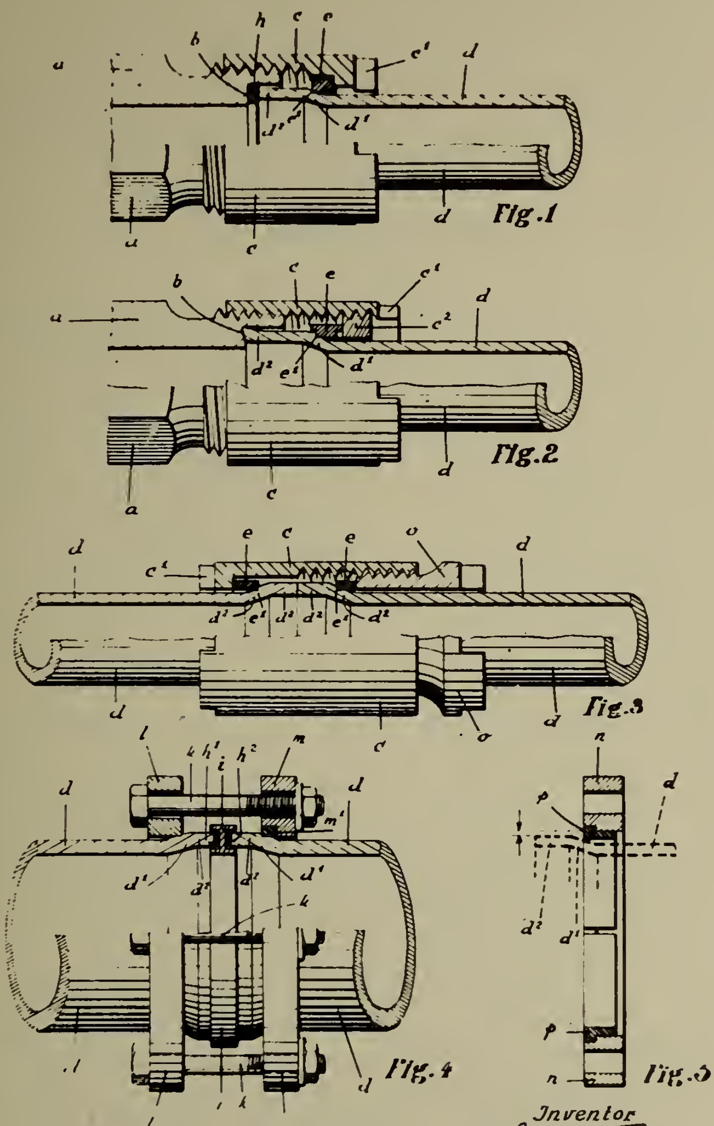

Inventor
Hans Kreidel

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ALIEN PROPERTY CUSTODIAN

WEIGHING APPARATUS

Vladimir Popov, Prague, Bohemia; vested in the Alien Property Custodian

Application filed April 5, 1941

My invention relates to apparatus for weighing and sorting articles by weight and it is an object of this invention to provide apparatus of the character referred to capable of realizing a weighing process which renders possible to ascertain the weight differences of the articles in comparison with a predetermined correct weight.

It is also an object of this invention to provide improved and more sensitive means for grading or sorting the articles by weight, e. g. into three groups: under the weight limit, within the limits allowed and over the limit.

It is a further object to provide means in the said apparatus which enables to record, in a suitable way, the result of every weighing operation effected on the apparatus.

These objects are effected by my invention, as will be apparent from the following description and claims taken in connection with the accompanying drawing in which:

Fig. 1 is a diagrammatic view of preferred embodiment of the apparatus in arrested position, whereby an electric control is provided,

Fig. 2 shows the mechanical control in connection with the apparatus shown in Fig. 1,

Fig. 3 shows the same apparatus in the released position and after a finished weighing operation,

Fig. 4 illustrates the recording mechanism which is actuated in dependence of the weight of the measured article, and

Fig. 5 shows a detail of the last-named recording mechanism.

To achieve the specified objects of my invention my apparatus comprises a weighbeam which is provided with a scale-pan for the measured articles, on one arm and a counterweight on the other arm, and a dynamometric spring serving to ascertain and measure the value of the weight differences i. e. the differences between the correct and the actual weight of the articles. This spring is not sprung in the rest position and acts on the weighbeam only by its own weight in positive or negative sense with regards to the counterweight in accordance to that, on which arm of the beam it is placed. When this spring is stretched during the weighing operation it acts on the beam dynamically within close limits, which correspond approximately to the allowed weight tolerances of the articles.

The dynamometric spring is thus a very fine organ which is subjected only to slight stresses within predetermined limits, sufficient for ascertaining the weight differences, so that this spring is not exposed to the full load of the article and its function can be composed with that of a rider used in connection with an ordinary analytic balance.

To achieve a sufficient stability and elasticity of these springs, the same can be made of a thin glass fibre for measurements in the limits of 0.01 gramme, of thin bronze wire from 0.01 up to 0.1 grm. and of thin steel piano-wire over 0.1 grm. The springs made of said materials are so sensitive that great amplitudes are obtained by small loads, e. g. a load of 0.01 grm. can produce a compression or elongation of 3–5 mm, so that the scale shown in the drawing can be considered as being in actual size. This sensitivity is sufficient for ascertaining and recording the weight differences with an accuracy equal to that of an ordinary analytic balance.

The invented apparatus comprises furthermore means for loading the spring by a force which is independent of the weighbeam as well as of the weight of the article, this means actuating simultaneously a registration member which, in dependence of the actual weight of article, indicates and respectively also records the value of the weight differences. The said registration member may be used to operate any suitable known device for sorting the articles by weight, this device being not described in detail in my description.

According to its utilization, my apparatus can be adapted either for mechanical or for hand operation. For the sake of simplicity, the described and illustrated embodiment relates to a hand operated apparatus.

Referring now to the drawing, the numeral 1 indicates the articles, the weight of which should be checked and ascertained by the invented apparatus. These articles are transferred one by one to a scale-pan 2 suspended on the right arm of the weighbeam 3. The correct weight of the articles should be e. g. 3 grammes with with maximum allowed tolerances ±0.02 gram., i. e. the lowest admissible weight is 2.98 grm., the highest 3.02 grm. For this purpose the left arm of the weighbeam 3, which is suspended in the bracket 4, is loaded with a counterweight 5 and with a dynamometric spring 6, which together imposes such a weight that the left arm of the weighbeam is slightly less charged than the right arm, when an article having the minimum admissible weight, i. e. 2.98 grm. is laid on the scale-pan.

A stabile abutment 7 prevents the weighbeam to swing in one direction (to the right according to Fig. 1). The swings of the weighbeam in the other direction can be effected only

after an arrestment member 8 has been released. This member holds the beam in horizontal position during arrestment and releases the same for swings when it is lowered down.

Supposing that the right arm of the weighbeam 3 is loaded by an article having a weight of 2.98 grm. and that the arrestment is released, the weighbeam will remain resting on the abutment 7, as the total of the counterweight 5 and of the weight of the spring 6 is slightly less than 2.98 grm. Thereby it is supposed that the spring 6 is suspended freely and subject to no force in the moment of releasing of the arrestment.

The arresting and releasing movement of said member 8 is realised by a series of organs, which will be described later on.

A gear wheel 11 is connected with a crank handle 9, which, in the arrested position, rests on an abutment 10. After one half of a revolution in the direction *a*, the handle 9 is stopped by the abutment 12 (Fig. 3). During this rotation, the plate 13, which is rigidly connected to a rack 14, engaging constantly the gear wheel 11, effects a movement from its upper position A—B (Fig. 1) into the lowermost position C—D (Fig. 3). In the same time, the arrestment member 8 is lowered down and the weighbeam is released.

As soon as the weighbeam executes a small swing to the left, the contact of the beam with the abutment 7 is interrupted and, on the other hand, the beam touches a contact-closing screw 15, hereby completing an electric circuit comprising a current-generator 16 and a solenoid 17.

The completion of the circuit can naturally be realized also by other means, such as e. g. by means of a photo-cell which is far more sensitive and reacts upon the slightest movement of the weighbeam. Also, in the mechanism described and shown in the drawing, the movement of the rack 14 is obtained by hand, but arrangements for automatic operation of the same can easily be taken by those skilled in the art.

During the positive downwards movement of the plate 13, the dynamometric spring 6 is stretched, automatically and without regard to the weighbeam or to the weight of the measured article, up to a predetermined maximum which is given by the lowest position C—D of the plate 13 (Fig. 3).

In addition to said members 6 and 8, a rod 18 of a registration mechanism cooperates with the plate 13, said rod passing freely through the bushes 18*a*, 18*b* and resting by its own weight upon the plate 13.

Supposed that an article having the exact correct weight of 3 grm. is laid on the scale-pan 2 and that the dynamometric spring 6 is dimensioned in such way that a weight of 0.01 grm. produces an elongation corresponding to one point of the scale 19. The registration rod 18 follows the downwards movement of the plate 13, until the electric circuit of the solenoid 17 is completed by the contact-closing screw 15, upon which the lever 20 is shifted by the action of the solenoid 17 into the position according to Fig. 3 and its nose 21 engages a tooth-space of the rod 18, thus hindering its further movement.

If the weight of the article is equal to the correct theoretical weight, the contact of the weighbeam 3 with a screw 15 will be assumed and the movement of the registration rod 18 with the pointer 22 stopped, after this rod has travelled from its upper position, in which the pointer 22 indicates the minus mark against the scale 19, to the position, where the pointer indicates zero on the scale. This moment corresponds to the mid-way position of the plate 13, as denoted by letters E—F in Fig. 3. The plate continues its movement to its lowest position C—D, but the registration rod 18 is held in the arrested position by the nose 21 of the lever 20. The rod is returned to its original position later on during the backward movement of the plate 13 to the position A—B.

An article having the correct weight can be used for checking the correct adjustment of the apparatus and of the dynamometric spring 6. If this spring is correctly dimensioned, the articles of a weight of 3–0.01 grm. will produce the arrestment of the rod 18 with the pointer 22 standing opposite the 0.01 mark over the zero-line, the articles of 3–0.02 grm. opposite the 0.02 over the zero-line, whilst articles under 3–0.03 grm. will not influence the rod 18 at all, as the arm of the weighbeam loaded by this light article will close the contact with the screw 15 immediately after the releasement of the arrestment and the registration rod 18 will be blocked by the lever 20 even before it could execute any movement.

The swing of the weighbeam 3 from its position of rest on the abutment 7 into the position of contact with the screw 15 should of course be so small as possible.

If the articles possess a weight over 3 grms., e. g. 3.01, 3.02 grm., the rod 18 will be stopped with the pointer 22 standing opposite the corresponding marks 0.01, 0.02 underneath the zero-line of the scale. If the weight of the article exceeds 3.03 grm., the rod will follow the movement of the plate 13 to its lowest position and the contact will indicate the plus mark of the scale 19.

It is clear, from the above said, that for every article having the allowed weight, the registration rod 18 will be stopped with the pointer 22 indicating in the limits of 0.02 over and 0.02 under the zero-line of the scale. For the articles over the limit, the pointer 22 will stand over the 0.02 mark and for the inadmissibly heavy articles underneath the 0.02 mark under the zero-line.

It is also clear that the accuracy of the weighing increases in same measure as the movement of the plate 13 is slower and the gearing of the rod 18 finer.

The electric control of the registration rod 18 can be replaced by mechanical means, as shown in Fig. 2. This figure shows a two-arm lever 23, which cooperates with the weighbeam 3 and blocks the movement of the rod 18 as soon as the weighbeam executes a swing. To this effect, a gear-wheel 24 engages the gearing of the rod 18 and the nose 23*b* of the lever 23 is adapted to engage this wheel, when the end 3*a* of the weighbeam 3 presses down the arm 23*a* of the lever, the movement of the rod 18 being thus prevented.

The registration rod 18 can be provided with a member 25 which serves to record the movements of the rod 18 during every weighing operation e. g. on a paper band 26 wound on the drum 27, as shown in Figs. 4 and 5.

The drum 27 is rotated by means of a clockwork or similar mechanism, preferably with interruptions in the time of arrestment of the weighbeam. The paper band 26 can be ruled and provided with minus and plus marks and numbers similarly as the scale 19 in previous case.

As the recording member 25 effects, during

every weighing operation, a movement downwards and upwards and the drum **27** with the paper band **26** rotates, a curve will be recorded on the band, as shown in Fig. 4. From this curve, the weight of every individual measured article can be ascertained. The point *c* of the curve shows that the measured article was too heavy, the point *d* corresponds to an article under the weight limit, the point *e* to an article of allowed weight and the point *f* shows that the measured article has the correct theoretical weight.

VLADIMIR POPOV.

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V. POPOV

WEIGHING APPARATUS

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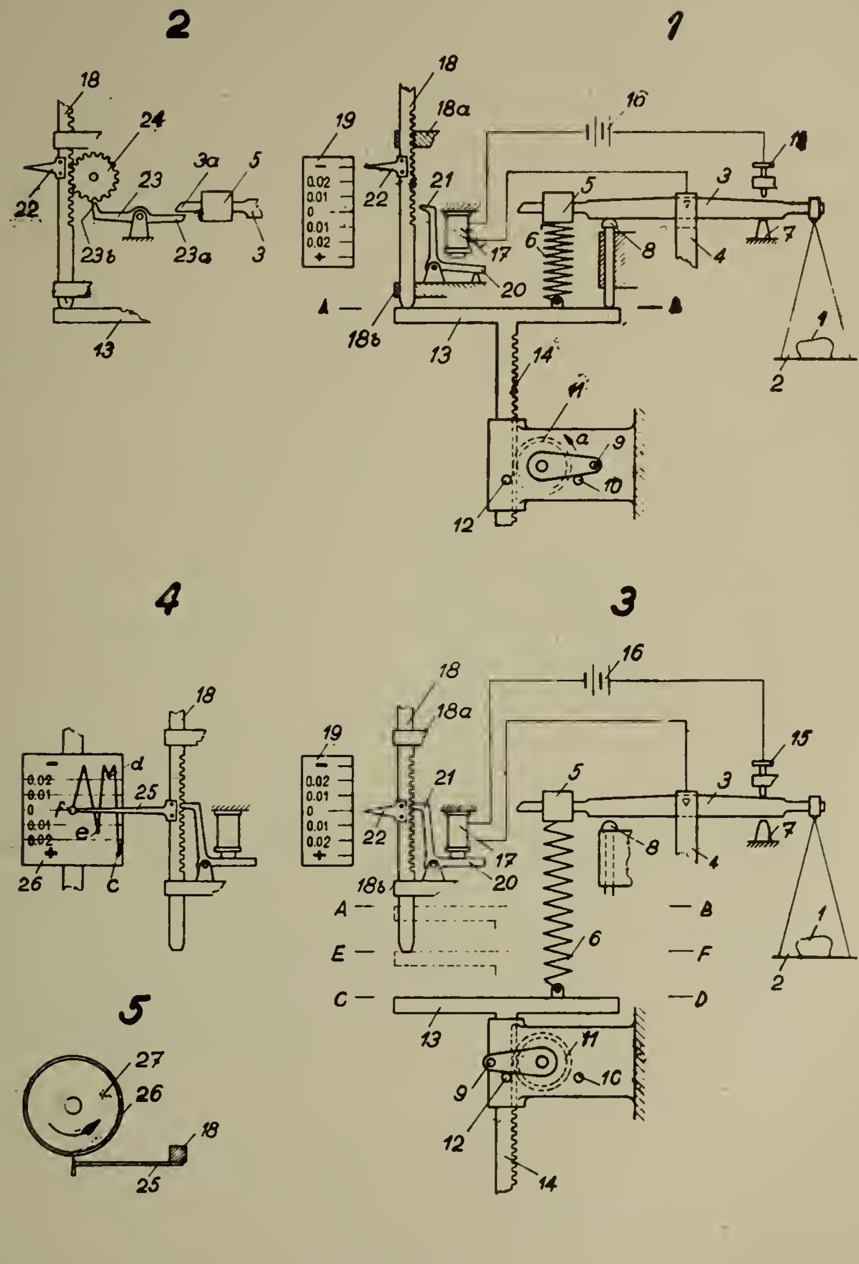

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ALIEN PROPERTY CUSTODIAN

ELECTRON TUBES

Edmund Löpp, Berlin, Germany; vested in the Alien Property Custodian

Application filed April 9, 1941

In electron tubes for short waves the supply leads should be short and the insulating materials are required to be of low dielectric losses. Where the tubes are to be interchangeable they must be provided with a suitable base or the glass bulb must be shaped to perform the office of such base.

According to my copending application Serial No. 335,048, filed May 14, 1940, the vessel of electron tubes may be made entirely of glass, no insulating material other than glass being needed.

An electron tube so constructed is shown in the drawing, which is a sectional view thereof and also represents by way of example the improvement described hereafter.

The bulb 2 has a base carrying inleads 3 sealed into the bottom 10 thereof. The leads 3 support the electrode system 6 in well known manner and are to engage with contact means, not represented, of a socket 7' of which only so much is shown as is necessary for understanding the invention. The inner surface of the bottom 10 has flutings or corrugations 5 or may be provided with radial grooves. This adds to the insulating property of the base.

In accordance with the present invention the bottom 10 is arranged to act as a stop for the socket 7'. Preferably, bottom 10 is a reentrant part of the bulb. The base of the bulb is thus formed with an annular wall portion encircling the leads 3 in a manner to protect them from injury.

The novel arrangement has the advantage that the inductance of the supply leads is the same in the case of all electron tubes of a definite construction. This is important especially for short wave tubes since here small differences between the inductance of the supply leads of one tube compared with another require the adjusted transmitter or receiver to be readjusted.

EDMUND LÖPP.

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E. LÖPP

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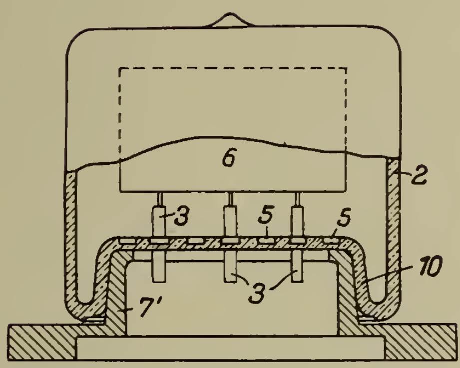

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Att'y

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ALIEN PROPERTY CUSTODIAN

STRETCHING APPARATUS

Hans E. Linthout, Krummhubel, Germany; vested in the Alien Property Custodian

Application filed April 9, 1941

The present invention relates to an apparatus for stretching a human's body and for improving the tallness and the hold of the body. Apparatus of this kind are known in which drawing or pulling means, for instance bands or ropes, attaching the head to a special head-rest of a practicing person are wound upon a rod by rotating or turning the latter. The ends of these bands are fixed to the rotatable rod and therefore, the length of the bands or ropes may be adapted to the tallness of the practicing person or to the desired holding of the arms of this person only by more or less winding the one or the other set of bands or ropes upon the rod before starting the treatment. This adjustment, however, is somewhat complicated particularly if the entire apparatus is suspended from a hook arranged relatively high.

To obviate these drawbacks and to obtain a particular convenient adjustment, the apparatus for stretching a human's body is, in accordance with the present invention, so constructed that the drawing or pulling means, preferably consisting of a single band or rope or of several juxta-positioned bands or ropes is uninterruptedly led to the suspension device, formed for example by a ring, and is connected to the rotatable rod in such a manner, that the latter may freely be displaced relatively to the drawing or pulling means.

In a rather simple manner this may be obtained by guiding the drawing or pulling means in a closed or open cramp fixed to the rotatable rod or in a slot provided in the rotatable rod. On turning or rotating the rod both parts of the band are wound up one over the other. If the drawing or pulling means consists of a single band, it may be connected to the head-rest in such a manner that a band each is led from its end and connected to the lateral members of the head-rest. When practicing these bands are tensioned and thereby pressed against the sides of the head which is felt by many practicing persons to be disagreeable. This inconvenience may be obviated by connecting the drawing or pulling means to the head-rest by means of a stirrup. Preferably a resilient stirrup is used, whereby a soft starting of the strain during practicing is ensured and an over-straining of the body of the practicing person is prevented. The resiliency of the stirrup may, moreover, be utilized to control, by effecting measurings, the tension acting upon the body, by making the stirrup a portion of a measuring apparatus operating in accordance with the principle of a spring balance. To obtain this purpose besides the head-rest two rods or the like may be connected to the ends of the stirrup at the free ends of which a pointer adapted to move over a scale is rotatably arranged.

Further details of the invention may be seen from the following specification and the drawing which shows some constructions according to the invention by way of example.

In this drawing:

Fig. 1 is a general view of an apparatus for stretching a human's body,

Figs. 2 and 3 show two modified constructions of connecting the drawing or pulling means to a rotatable rod,

Fig. 4 illustrates a manner of fixing an apparatus according to the invention to a door,

Figs. 5 and 6 show another manner of fixing the apparatus to a door,

Fig. 7 shows the construction of the stirrup as measuring apparatus, and

Fig. 8 is a side view of the head-rest.

The apparatus for stretching a human's body shown in Fig. 1 consists of a rotatable rod 1 provided with handles 2, a band 4, the length of which may be adjusted by means of a buckle 3 and a head-rest 6 connected to the band 4 by way of a stirrup 5 of steel. The band 4 is guided in a cramp 7 which in the present case is closed and fixed to the rotatable rod 1. Provided at the free ends of the band 4 is a ring or an annular ear 8 by means of which the band 4 may be suspended from a door handle 9 as shown in Fig. 4 or from a hook fixed in the wall.

Instead of a single band 4 two bands 10 fixed to the ends of the head-rest 6 may be provided in which case eventually the stirrup 5 may be omitted. As shown in Fig. 2 the guide cramp 12 fixed to the rotatable rod 11 may be open or as shown in Fig. 3. The rotatable rod 15 may be provided with a slot 17 receiving the band 16. As may be seen from Figs. 5 and 6 the ring or annular ear 8 shown in the construction according to Fig. 1 may be replaced by leading the end of the band 18 around a piece of round timber 12 or the like and fixing same against displacement by a clasp 20 surrounding both parts of the band and having the form of a flat pressed ring. The end of the band thickened in this manner is then placed upon the upper edge of the door 21 which thereupon is closed so that now the end of the band is held between the door 21 and the door frame 22. The clasp 20 also may be a clamping buckle and

form a substitute for the adjusting buckle **3** of the apparatus according to Fig. 1.

Fig. 6 shows the stirrup constructed as measuring and control apparatus. To the free ends of the stirrup **25**, attached in the manner shown in Fig. 1 to a band **27** by means of an ear or ring **26** provided at its middle portion, rods **28** and **29** are connected at the free ends of which a pointer **30** is rotatably mounted. If due to a bending of the stirrup the distance of the ends of the latter from each other is altered this pointer is moved over a scale **31** carried by the stirrup **25** and thereby indicates the tension acting upon the stirrup and therefore also upon the body of the practicing person. A head-rest **32** formed in the manner of a collar smoothly surrounds all the parts of the head and distributes the tension strain over a large surface. The head-rest **32** is connected to the ends of the stirrup **25** by means of bands **33**.

HANS E. LINTHOUT.

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H. E. LINTHOUT

STRETCHING APPARATUS

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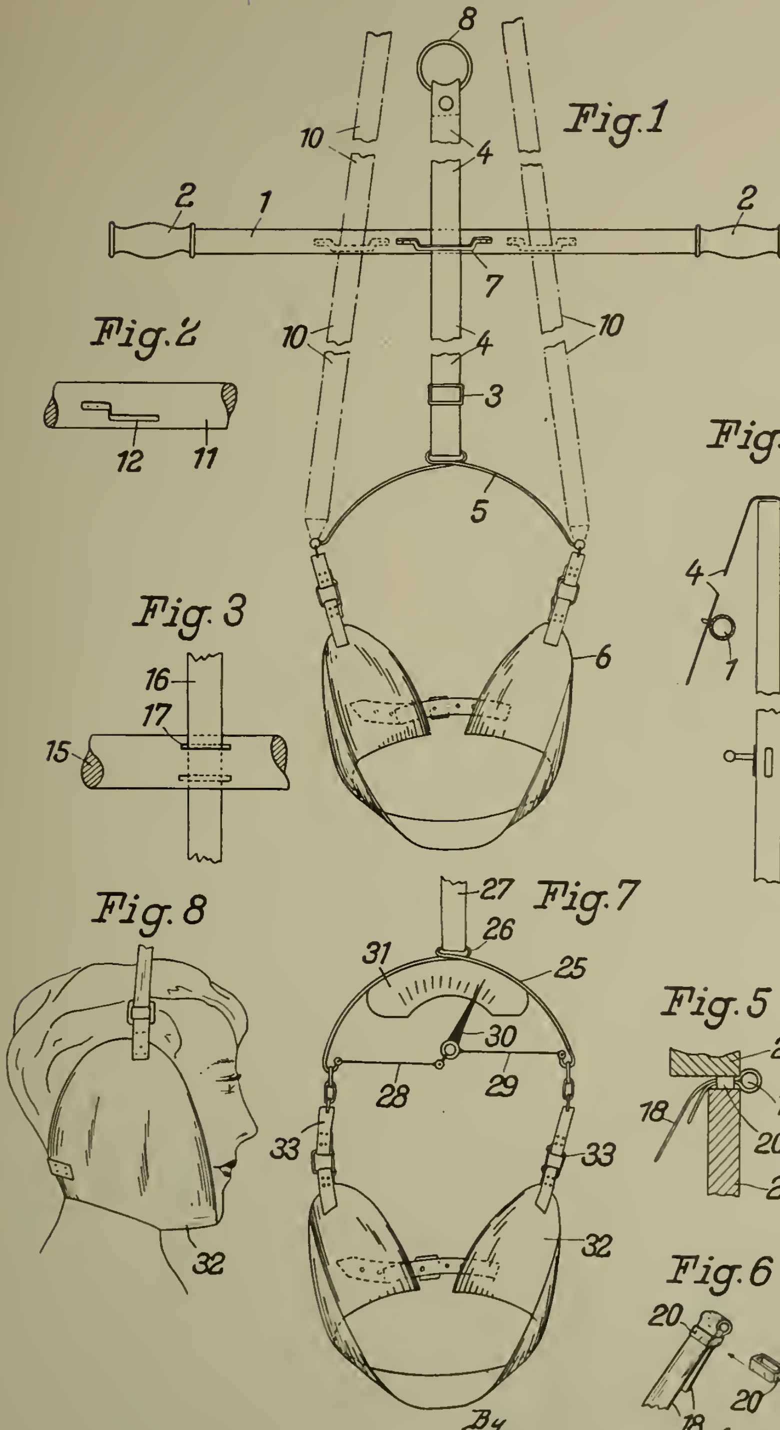

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ALIEN PROPERTY CUSTODIAN

AUTOMATIC PILOTING OF MARINE OR AERIAL VEHICLES

Marcel Louis Gianoli, Lyon, France; vested in the Alien Property Custodian

Application filed April 11, 1941

The present invention has for object certain improvements in the automatic piloting of marine or aerial vehicles. These improvements are mainly intended to considerably simplify automatic piloting systems.

A first part of the invention concerns vehicles such as aeroplanes which are so devised that any transverse inclination relatively to apparent gravity causes a turning towards said inclination with a speed which is proportional thereto. This property can be imparted to the aeroplane, either by the forms, arrangements and proportions of the empennage and aerofoil, or by sliding detectors acting on the steering rudder, such as weathercocks, differential pressure-gauges, lateral pendulums, or autopter units described in the French Patent No. 825,922, dated 30th November 1936. In this case, the invention consists in arranging on the vehicle in question a steering detector (and in particular of the yawing speeds), which can comprise a precession gyroscope, and in causing said detector to act not on yawing rudders, but on rolling rudders, or in other words, on transverse inclination rudders.

In an aeroplane (or other marine or aerial vehicle) thus improved, the automatic piloting apparatus is considerably simplified. In fact, since the aeroplane has the property of effecting yawing movements so as to rapidly come back, damped, to the same initial sliding value (for instance null) when it has departed therefrom, any transverse inclination of the aeroplane is instantaneously translated by a speed of yawing rotation proportional to said transverse inclination, so that it becomes possible to pilot and steer the aeroplane by means of its warping rudders and ailerons, without the addition of a supplementary mechanism on the steering control.

The simplification is considerable since it includes the complete elimination of any control of the steering rudder, the adjustment of the latter remaining locked in the position corresponding, for instance, to null sliding, either because it presents the autopter function as described in the French Patent No. 825,922 dated 30th November 1936 and that its adjustment is maintained at zero, or because it directly or indirectly obeys a sliding weathercock or a transverse pendulum the control linkwork of which has been definitely adjusted.

The automatic piloting mechanism of the warping can then be presented in various forms, some of which are described hereinafter by way of examples.

According to the technics of the use of free gyroscopes, a single gyroscope 1 having an axis 2 (Fig. 1) can be arranged at right angles to the plane of symmetry of the aeroplane; if it is assumed that the end 3 of said axis is mounted as a spherical joint and that the end 4 controls the warping rudders and ailerons, it can be imagined that the rod 5 adapted to transmit the orders is located in the plane XO2 parallel to the plane of symmetry. In the case of said Figure 1, it will be seen that the order transmitted is the same whether the aeroplane turns to the right, or whether it inclines to the right; if in both cases said order is intended to incline the aeroplane to the left, it will also overcomea rolling disturbance and a yawing disturbance.

This simple mechanism ensures the return to rectilinear flying in the case of stoppage of a side engine for instance, since the yawing speed is proportional to the rolling divergence. As this yawing speed is compulsorily annulled by the detection of divergence increasing in the direction given by the gyroscope, equilibrium is established at the rolling inclination which creates, by sliding, a yawing torque balancing the lack of balance due to the stoppage of the engine. The addition on the linkwork 5 of a compensation slowly modifying the length of the warping linkwork until the divergence of the gyroscope according to OX is annulled, will also have for effect to bring back the steering to the initial head, the aeroplane flying correctly inclined, the stopped engine being at the top.

On the other hand, automatic piloting apparatus have already been proposed in which the steering rudder is controlled by its detectors and by rolling detectors. But the present invention concerns, in the embodiment which will be described, an arrangement according to which it is the warping rudder which alone is controlled, and not only by the steering detectors as in the case previously described, not only by the rolling detectors, which corresponds to the usual arrangement, but by a coupling in parallel of these two kinds of detectors, which is only possible on an aeroplane having the property previously defined.

In this case, and according to the technics of precession gyroscopes coupled to an instrument, a single gyroscope 6 (Fig. 2) can be arranged, set as the preceding one and responsive to rolling speeds, coupled to a compass 7 detecting the direction. The gyroscope 6 will damp the rolling disturbances, the aeroplane always coming back transversely to the horizontal by the action of the

compass 7 which inclines it, in order to bring back the aeroplane to the initial course.

It will also be advantageous to provide the gyroscope in such a manner that it is responsive to yawing speeds and always coupled to the compass (fig. 3). The gyroscope 8 will damp the rolling disturbances because they instantaneously give rise to yawing speeds, and in addition it will energetically damp the yawing disturbances. As in the case of fig. 1, the stoppage of a side engine will give rise to a yawing speed and to a rolling inclination, equilibrium being finally established by a certain divergence from the head, a certain transverse inclination of the aeroplane and further rectilinear flying; if a compensation mechanism has been added, the initial head will moreover be re-established, the aeroplane flying correctly inclined, the stopped engine being at the top.

It has finally been proposed to use, for controlling a single rudder, a detector simultaneously responsive to two reference axes: it is thus that automatic piloting apparatus are known in which the steering rudder is controlled by a free gyroscope or precession gyroscope the axis of which is inclined in such a manner that it is simultaneously responsive to rolling and yawing rotations. But, according to the invention it is the warping rudder which alone is controlled, and by a detector responsive both to rolling and to yawing, which is only possible on an aeroplane having the property previously defined.

Fig. 4 gives, for instance, a solution corresponding to the known means in which the gyroscope 9 is simultaneously responsive to yawing and to rolling, so that, with the same results as those of fig. 3, the rolling disturbances are also immediately piloted, by avoiding the delay caused by the use of the yawing movement determined by the steering rudder following a rolling disturbance.

Another part of the invention relates to the case of an aeroplane provided with stabilizing devices adapted to maintain constant, relatively to the air, the incidence detected at the rear of the centre of gravity of the aeroplane. This aeroplane thereby presents the property of effecting pitching movements so as to rapidly return, damped, as set forth in the French Patent No. 839,030, of the 29th November 1937, to its initial incidence when it has departed therefrom. It then becomes possible to simplify most of the automatic piloting and pitching devices. In fact, the latter, since they must instantaneously overcome the variations of the inclination relatively to the horizontal or the variations of speed, have a considerable action on the setting of the elevator, and from this important action might result in certain cases, the appearance of slow pitching oscillations, slightly damped or even amplified. That is why, for instance, certain mechanisms having a free gyroscope adapted to maintain constant the inclination relatively to the horizon, are provided with a longitudinal pendulum applied to the gyroscope, which thus supplies, by precession, an order proportional to the derivative of the inclination relatively to the horizon, which ensures the damping of the oscillations. Other anemometer mechanisms adapted to maintain the constancy of the speed, are provided with a precession gyroscope adapted to damp the oscillations which the anemometer piloting alone would allow to pass and would amplify. The same would be true if the anemometer was replaced by a longitudinal pendulum. In these various cases, the property imparted to the aeroplane by the stabilizing devices adapted to ensure the damping of the pitching oscillations will allow of using a free gyroscope without a coupled damping pendulum or an anemometer alone, or a pendulum alone. In all these cases, the action of the instrument on the setting of the rudder can be so much the more reduced as said instrument supplies orders the more delayed relatively to the disturbances to which the aeroplane is subjected, either in the case of the gyroscope it still pilots a great deal during the instantaneous disturbances and ensures, in addition, the slow modification of the length of the linkwork, the constancy of the inclination relatively to the horizon notwithstanding the permanent equilibrium disturbances; or, in the case of the anemometer it pilots but slightly during the instantaneous disturbances, its effect being in particular to slowly modify the length of the linkwork to maintain the speed constant.

MARCEL LOUIS GIANOLI.

PUBLISHED
MAY 25, 1943.
BY A. P. C.

M. L. GIANOLI
AUTOMATIC PILOTING OF MARINE
OR AERIAL VEHICLES
Filed April 11, 1941

Serial No.
388,039

Fig. 1.

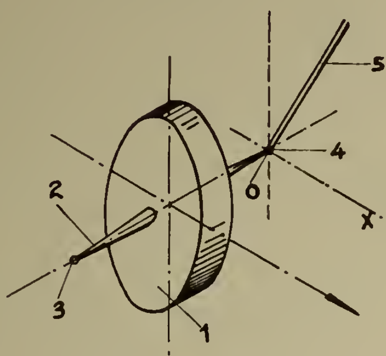


Fig. 2.

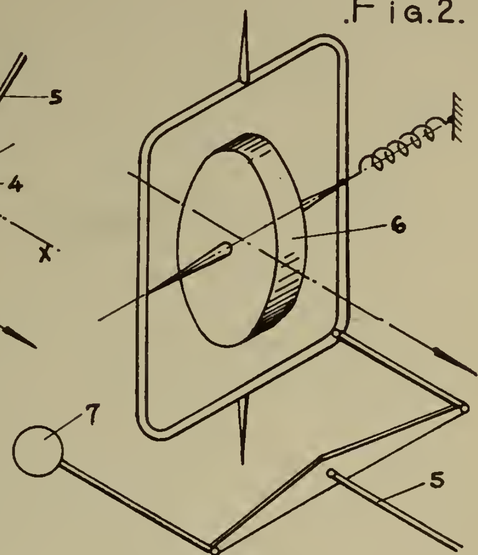


Fig. 3.

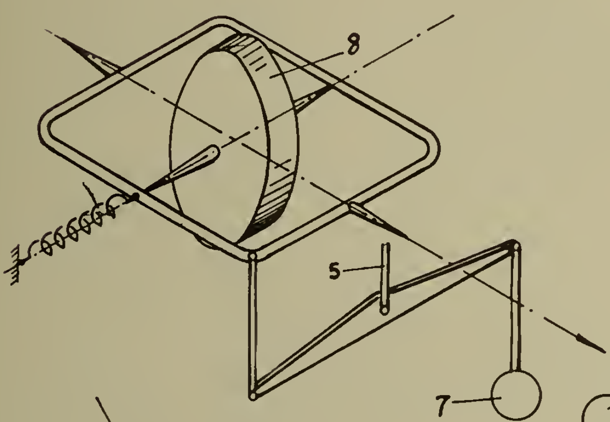
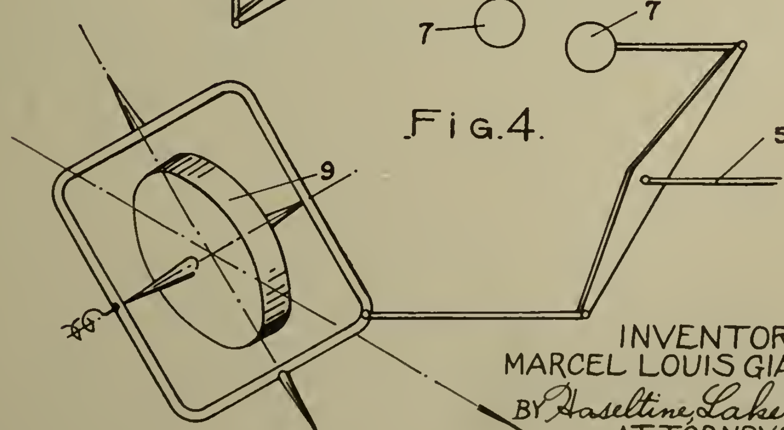


Fig. 4.



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ATTORNEYS

Published May 25, 1943

Serial No. 388,867

ALIEN PROPERTY CUSTODIAN

CLOSING DEVICE FOR ORGANISM CULTURE VESSELS

Hans Knöll, Jena, Germany; vested in the Alien Property Custodian

Application filed April 16, 1941

This invention relates to a closing device for cylindrically walled organism culture vessels. Formerly, the covers for closing culture vessels used for bacteriological investigations were so designed that, on having covered the vessel, a more or less capillary interspace existed between the cover and the wall of the vessel, said interspace filling wholly or partly with condensation-fluid while the charged vessel was being sterilized. This condensation-fluid reaching from the mouth of the vessel up to the rim of the closing cover, the contents of the vessel were subject to infection. Furthermore, there is a possibility of an air-infection taking place through the air space occasioned when the fluid-layer in question should dry up.

To eliminate these drawbacks the invention provides that that part of the cover lying between the cylindrical part and the bottom is made to bulge out in annular fashion, said bulge preventing a continuous fluid-layer to form from the edge of the vessels to the rim of the closing cover. The introduction, of a large air space between the cylindrical part and the bottom of the cover furthermore increases the protection from air-infection in that the further advance of the bacteria is effectively impeded in the said interspace.

A further advantage will be if the bottom of the cover is vaulted towards the inside thus permitting the moisture precepitating on the inside of the bottom of the cover to drop down into the vessel.

In the annexed drawing a constructional example of the invention is shown in longitudinal section.

Number **1** designates a closing device of glass intended for a culture flask **2** provided with a bottle-neck **3**. The bottom **4** of the closing device is vaulted towards the inside, while an annular bulge **5** is provided for between the bottom and the cylindrical part **6** of the device.

HANS KNÖLL.

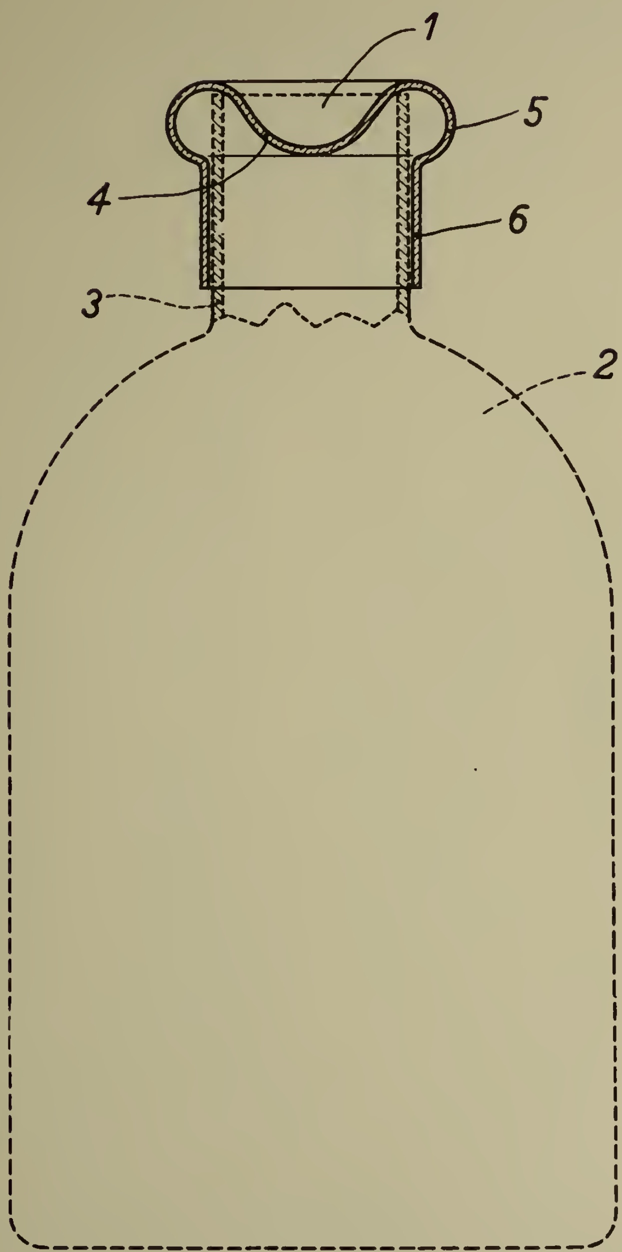
PUBLISHED
MAY 25, 1943.
BY A. P. C.

H. KNÖLL

CLOSING DEVICE FOR ORGANISM CULTURE VESSELS

Filed April 16, 1941

Serial No.
388,867



Inventor:
Hans Knöll

Published May 25, 1943

Serial No. 388,699

ALIEN PROPERTY CUSTODIAN

LIQUID SPRAYING APPARATUS

Erik Rotheim, deceased, late of Oslo, Norway, by Erica Rotheim and Hagbarth Rotheim, heirs, Oslo, Norway; vested in the Alien Property Custodian

Application filed April 15, 1941

The present invention relates to liquid spraying apparatus of the type in which the liquid, which is stored in a pressure container provided with an outlet member controllable by an operator, has dissolved therein a substance, which is gaseous at usual room temperature and pressure, and which serves as a means to expel the liquid from said container when the operator opens the outlet member. The apparatus of this type hitherto known are sold to the customers ready for use, and when the liquid content of the apparatus has been used up, the apparatus has either been thrown to waste, or it had to be returned to the manufacturer for renewed filling with a new charge of liquid having a gas dissolved therein. This means heavy expenses and, moreover, the manufacturer may be compelled to keep in stock ready filled apparatus containing several different types of liquid.

It is the object of the present invention to remove these drawbacks. To this end the substance to serve as expelling means is distributed by the manufacturer in individual pressure containers, comprising a special valve, and the spraying apparatus proper or the outlet member thereof is provided with an arrangement for establishing communication between the valve of said container and the liquid container of the spraying apparatus, so that pressure substance may be transferred into the latter and become dissolved in the liquid therein. Thus the manufacturer needs to keep in stock and distribute containers filled with pressure substance only, and the customer may himself, at the place of consumption, fill his spraying apparatus with the desired liquid and dissolve pressure agent therein, and returns solely to the pressure substance containers to the manufacturer for refilling.

The invention therefore also covers a distributable pressure substance container for such use, and further covers also certain means for controlling the transfer of pressure substance from such container into the spraying apparatus.

The drawing illustrates by way of example an embodiment of apparatus according to the invention.

Figure 1 is a side view of the spraying apparatus connected to a pressure substance container, parts being broken away.

Figure 2 shows more or less diagrammatically a vertical section through the spraying apparatus in Figure 1, taken at right angles to the plane of the paper in Figure 1.

Figure 3 is a section illustrating a valve construction for the pressure substance container.

The spraying apparatus comprises a container 6 and a removable discharge arrangement provided thereon, which in the embodiment shown is in the general shape of a pistol. When charging the apparatus the pistol member is first unscrewed from the container 6, then the liquid to be sprayed is filled into said container 6, and the pistol member is again screwed thereon. Now the pressure agent in question, say propane, is introduced into the liquid in the container 6. Such pressure agent is delivered by the manufacturer in the form of liquified gas in containers 1, below called spheres. According to the invention now either the pistol member or the container 6 proper is provided with a device by means of which it may be brought into pressure-tight communication with the sphere 1. In the embodiment here illustrated the sphere 1 is brought in communication with the top of the pistol member by means of a valve device 2, which is shown more in detail in Figure 3 and will be fully described below.

When said communication has been established by means of the valve device 2 the latter one is opened and the pressure substance flows from the sphere 1 into the top portion of the pistol member. The latter is provided with a space 3 enclosing an indicator of suitable type (not shown) which indicates what quantity of pressure substance has passed through the same into the pistol member. Such indicator may for instance take the shape of a volume meter having a counting apparatus, the indications of which may be read through windows arranged in the walls of the chamber 3. However, the indicator might also consist of a manometer indicating the pressure which in each instance prevails in the container 6 and the pistol member.

From the space 3 the pressure agent flows through a non-return valve 4 and from there through a stop valve 5. The non-return valve 4 is not absolutely necessary, but has in some cases proved to be suitable. From the stop valve 5 extends a channel 7 through the pistol member, and in communication with said channel 7 is a tube which extends to near the bottom of the container 6. The pistol proper, through the nozzle of which the liquid with pressure agent dissolved therein shall later be sprayed, is of course closed to the atmosphere during the introduction of pressure agent into the container 6. The closing means necessary for that purpose are suitably arranged in the front part of the pistol. Thus, by means of the valves and communications described above the desired quantity of pressure

agent is introduced into the container, where it dissolves in the liquid. Then the valves 5 and 2 are closed, and if desired the pressure agent sphere 1 may be removed. The spraying apparatus now is ready for use. A pull exerted on the trigger 8 of the pistol member opens the communication between the container 6 and the nozzle of the pistol, and the liquid is pressed out either as a spray or as a fine jet, according to the height of the pressure and the type of nozzle used. During this operation the liquid is flowing upwards through the same channel 7 which was used for the introduction of pressure agent.

As above mentioned the channel 7 communicates with a tube extending practically to the bottom of the container 6. According to a feature of the invention said tube may consist of flexible material and is at its free end provided with a weight, so that the weighted end of the tube will always be positioned at the lowermost part of the suitably spherical container 6, even if the apparatus is kept in inclined position when in use.

Figure 3 shows on a larger scale a vertical section through an embodiment of the valve and connection device which in Figures 1 and 2 is generally designed by the numeral 2. Into a projection 10 on the sphere 1 is screwed a valve member 12 having a conical valve shoulder 11 cooperating with a corresponding conical valve seat on the extension 10. The screw wound part of the member 12 has a longitudinal central boring which closely over the shoulder 11 communicates with a radial narrow boring. The head of the valve member 12 is unround, for instance square, and fits into a corresponding shaped space 13 in the top part 14 of the pistol member. Said part 14 is externally provided with screw windings and cooperates with a nut 15 having pins or an annular flange 16 extending into a circular groove on the extension 10. Between the ends of the extension 10 and the part 14 is provided a stuffing disc 17, which if desired may be secured to the valve head 12, so that it always accompanies the sphere 1.

When the pressure agent is to be transferred from the sphere 1 the valve 12 is inserted into the space 13. Then the nut 15 is screwed on to the windings of the part 14 and thereby presses the extension 10 and the part 14 with the stuffing disc 17 therebetween against each other, so that gas tight connection is obtained. Then the operator turns the sphere a few turns backwards, so that the shoulder of the valve no longer rests tightly against the valve seat. The pressure agent therefore penetrates through the borings of the valve, past the valve seat and into the space 13, and from there to the container 6 as described above. Turning of the sphere 1 in the opposite direction again closes the valve 12, and then the connection between the sphere 1 and the pistol member may again be broken off. In order to make the turning of the sphere 1 more easy the latter may be externally corrugated or knurled.

The described valve device is also suitable for charging of the sphere with pressure agent in manufacturers plant. The part 14 then comprises a branch tube on a main for pressure agent, but as for the rest the filling operation is, as will be understood, quite analogous to that described above.

In some cases it may be desirable to provide a special pressure releasing valve for the container 6. In the embodiment here illustrated is shown such a valve 9 arranged in the pistol member and communicating with the top of the container through a bore in the pistol member.

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Heirs of the Estate of Erik Rotheim, Deceased.

PUBLISHED MAY 25, 1943. BY A. P. C.

E. ROTHEIM ET AL

LIQUID SPRAYING APPARATUS

Filed April 15, 1941

Serial No. 388,699

2 Sheets-Sheet 1

Fig. 1.

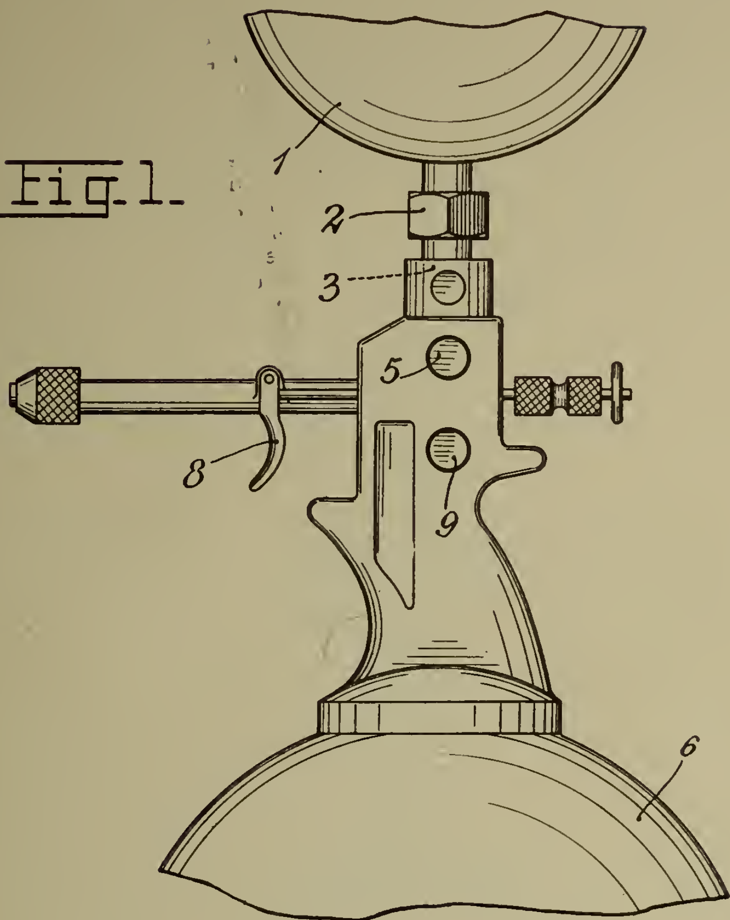
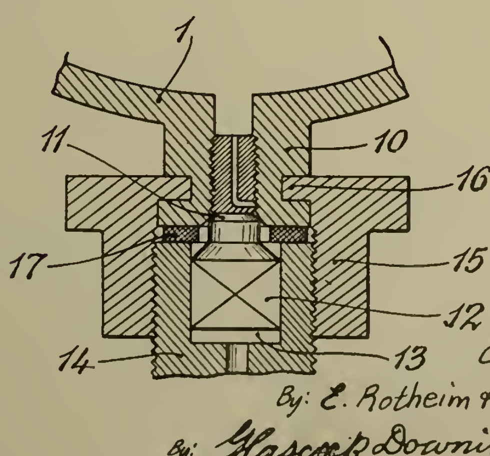


Fig. 3.



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By: Glascock Downing & Seebold Attys.

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Serial No.
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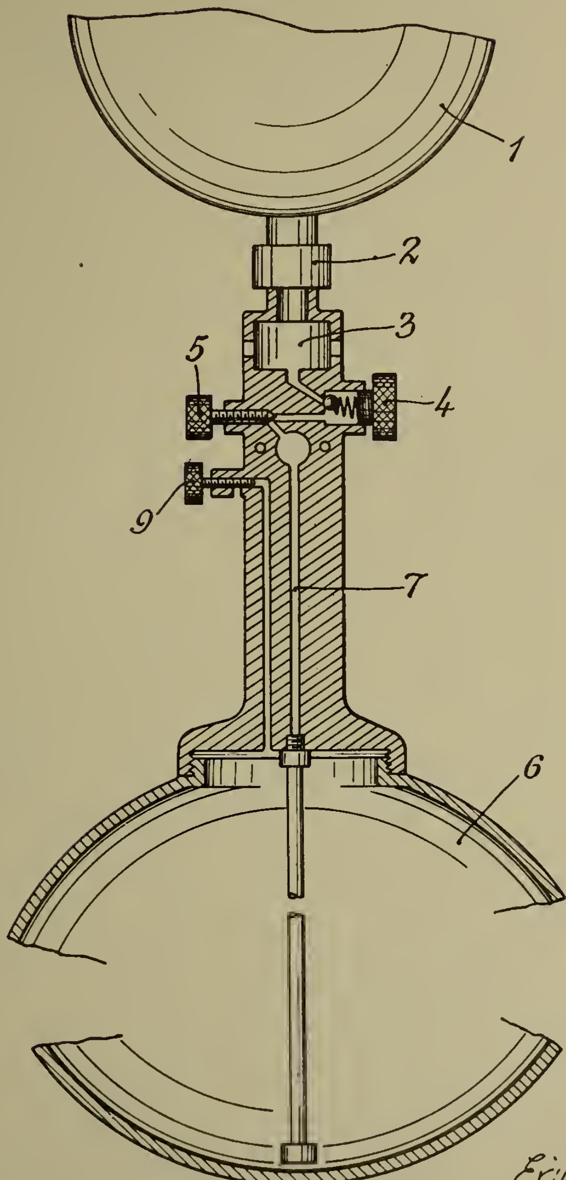
2 Sheets-Sheet 2

Fig. 2.



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By: Glascock Downing & Seebold
Attys.

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ALIEN PROPERTY CUSTODIAN

DIRECTIONAL ANTENNA WITH SUPPRESSED LOBES OR EARS

Ernst Gerhard, Berlin, Germany; vested in the Alien Property Custodian

Application filed April 17, 1941

It is known in the prior art to suppress undesirable secondary or lateral radiations known as lobes or ears (that is, secondary maxim) which arise in connection with the operation of a directional antenna (sheet antenna, parabola reflector, etc.) by making the current-covering or distribution of the entire antenna area not uniform, but in such a way that it declines in conformity with a definite law in the direction towards the edges of the surface.

According to the invention, the secondary maxima or lobes, for instance, of the horizontal diagram are suppressed by arranging several aerials being staggered in reference to one another in the horizonal sense below one another whereby any desired distribution of current of the antenna surface or area is obtainable, say, in horizontal direction as illustrated by the schematic embodiment, Figure 1.

The antenna shown in Figure 1 may be cylindric parabola reflectors, say, of the kind shown in Figure 2, or sheet radiators comprising a plurality of dipoles, for instance, of the kind shown in Figure 3, a plurality of which, mounted in one plane staggered in reference to one another, are assembled to result in a rhombic antenna, say, as shown in Figure 4. Figures 4 to 7 illustrate theoretically determined horizontal diagrams corresponding to the sheet antenna shown alongside the patterns. Figure 2 shows a perspective view of a cylindric parabola reflector **21** which may be used as the radiators **11–14** shown in Figure 1. The energizing antenna within the reflector is not shown but may be of any conventional type.

Figure 3 shows a broadside array **31** composed of a plurality of individual dipoles **32** so energized by transmission line **33** as to simulate a uniform current sheet. The individual radiating units **31** shown in Figure 3 may be combined as shown in Figure 4 in the practice of the present invention. The combination simulates a rhombic radiating sheet **41**. Due to the longitudinal stagger of the units **31** the desired radiation pattern is obtained.

Figure 5 shows the horizontal diagram of a plain sheet antenna **51** with uniform current distribution of 4λ width, λ being the operating wavelength.

Figure 6 shows the diagram corresponding to an antenna comprising two surfaces **51** and **61**, each of 4λ width, being staggered in reference to each other a distance equal to $4/3\lambda$ according to the invention. It will be noticed that the first and the second maxima are largely suppressed. Figure 7, finally, shows the diagram of an antenna comprising four sheets, each of 4λ width, being staggered in respect to one another. The arrangement results from staggering two schemes as shown in Figure 6 an amount equal to $\lambda/2$ in respect to each other. In this case, also, the third maximum has been suppressed appreciably.

In the exemplified embodiment of Figure 1 four sheet antennae **11**, **12**, **13**, **14**, all of which are to have a uniform current covering or distribution, are placed underneath one another. The flux of energy through the vertical sheet elements (indicated by the dash-lines) is proportional to the antenna surface contained in these surface elements. The energy flux is numerically indicated, in relative terms, for each surface element. By a predetermined horizontal shift and horizontal size or expansion of the various antenna surfaces indicated in Figure 1, any desired energy distribution in horizontal sense is attainable, with the result that either only the first maximum or only maxima of a higher ordinal number or else again all of them may be suppressed. The energy distribution required for each case is ascertainable by calculation by the application of known methods.

It will be understood that what has been shown in the exemplified embodiment for the horizontal direction applies naturally to any other direction, say, also the vertical diagram or space pattern.

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DIRECTIONAL ANTENNA WITH SUPPRESSED
LOBES OR EARS
Filed April 17, 1941

Serial No.
388,936
2 Sheets-Sheet 1

Fig. 1

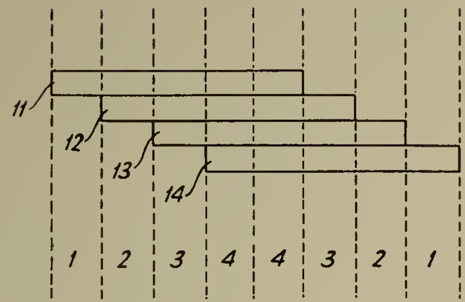


Fig. 2

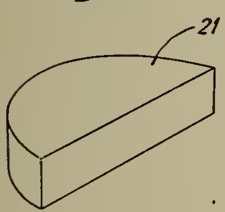


Fig. 3

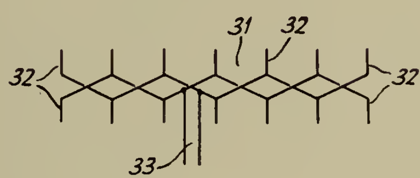
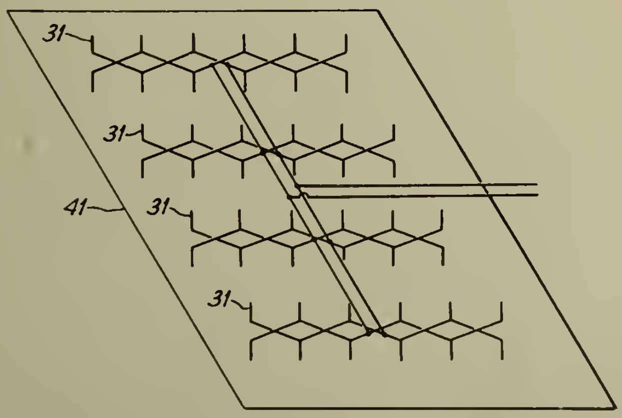


Fig. 4



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Serial No.
388,936

2 Sheets-Sheet 2

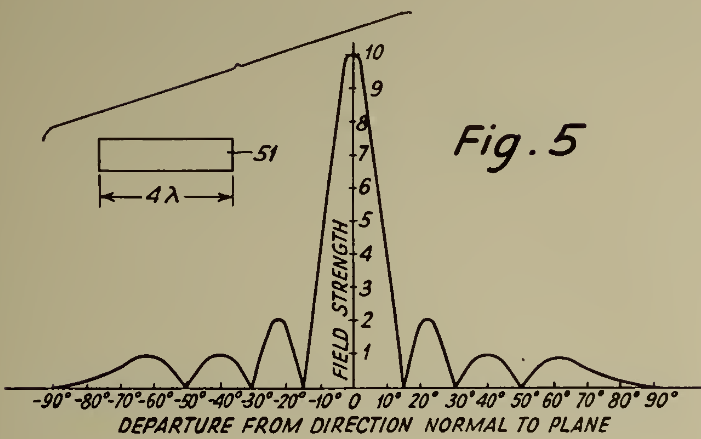

Fig. 5

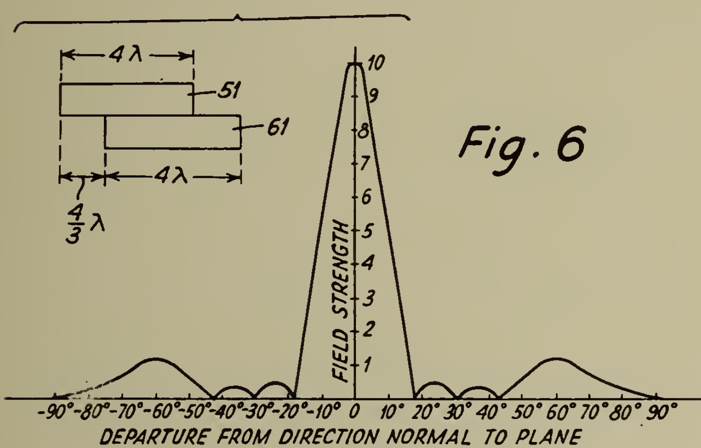

Fig. 6

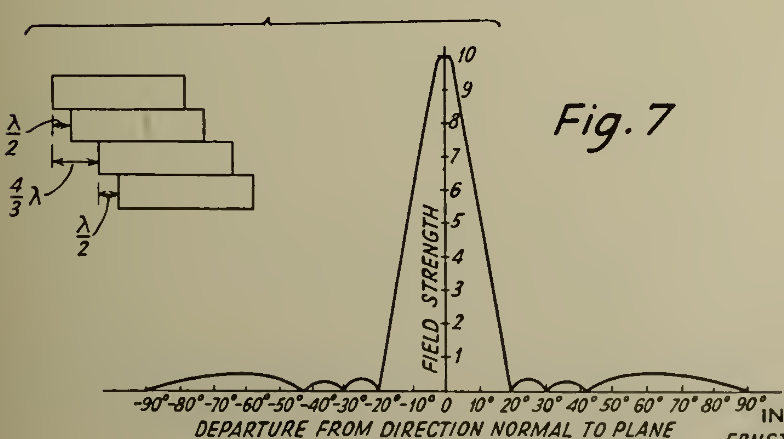

Fig. 7

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ALIEN PROPERTY CUSTODIAN

HEAT EXCHANGERS

Rudolf Hintze, Berlin-Charlottenburg, Germany; vested in the Alien Property Custodian

Application filed April 18, 1941

This invention relates to improvements in heat exchangers.

In heating or cooling systems, heat exchangers are often employed consisting of two metal sheets held together in flat condition and provided with grooves through which flows a heat transfer medium. Heat exchangers of this type are adapted for use in refrigerating apparatus as condensers or evaporators. Heat exchangers of the above-mentioned character had hitherto been, as a rule, so manufactured that the two plates provided with grooves were secured together around their edges by welding, various welding seams being also employed in the sheet portions between the single grooves. If heat exchangers exposed to a great inner pressure as this is, for instance, the case with condensers for refrigerating apparatus are employed in such systems, relatively great wall thicknesses for the metal sheets have to be used, since the inner surfaces of the two metal sheets lying between the single welding seams are exposed to a great pressure. If a great thickness of the sheets should be avoided this could only be attained by reducing the operating pressure. This requirement cannot always be readily fulfilled.

The object of the invention is to remove the above drawback and to provide a heat exchanger of the above-indicated character in which a very small sheet thickness may be employed for high inner pressures. This may be accomplished according to the invention by copper plating the two sheets forming the heat exchanger and by brazing them together by the copper coating thus formed, preferably in a protective gas atmosphere. In this manner a very high resistance to the gas pressure existing between the two sheets is attained so that only relatively narrow refrigerant grooves are stressed by the inner overpressure of the heat exchanger, whereas all surfaces of the two metal sheets being normally in contact with one another are not under the influence of the inner overpressure by the fact that they are secured together by brazing. By the invention it is possible to manufacture heat exchangers, for instance, evaporators for refrigerating apparatus from metal sheets having each a wall thickness of 0.5 mm or less.

The heat exchanger may be manufactured according to the invention in such a manner that the two sheets are copper plated and are brazed together at their contact surfaces by the copper coating thus formed, in a protective atmosphere according to a known method. The outer surface of evaporators or similar heat exchangers made of sheet metal are protected against corrosion by hard zinc plating the same or providing them with a varnish coating.

The invention may be applied to heat exchangers of any type, to all pressure vessels having great heat radiating surfaces, and particularly to evaporators for refrigerating apparatus for domestic refrigerators.

In the accompanying drawings is shown an embodiment of an evaporator manufactured according to the invention.

Fig. 1 shows an L-shaped evaporator manufactured of two sheets 1 and 2 provided with grooves 3 and a depression 4. The two evaporator sheets are not secured together as has hitherto been usual around their edges by welding, but the surfaces of the two sheets are brazed together in a gas-tight manner as described above.

Fig. 2 shows a sectional view through a part of a heat-exchanger. The two sheets 1 and 2 consist of sheet metal of, for instance, a wall thickness of 0.5 mm. The surface portions 4 of the width a (Fig. 2) are brazed to the corresponding surface portions of the opposite sheet wall. According to the invention it is therefore not possible that the surfaces of the evaporator sheets intimately in contact with each other offer great surfaces to the inner pressure, but only the grooves 3 of the novel heat exchanger are exposed to the inner overpressure.

If a larger tubular cross-section is to be chosen the form shown diagrammatically in Fig. 3 may be employed in which the depth t of the grooves in greater than the width b. This form of the grooves is particularly advantageous, since in the case of a relatively small distance a between the grooves the greatest possible outer heat exchange surface may be attained.

RUDOLPH HINTZE.

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BY A. P. C.

R. HINTZE

HEAT EXCHANGERS

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Fig. 1

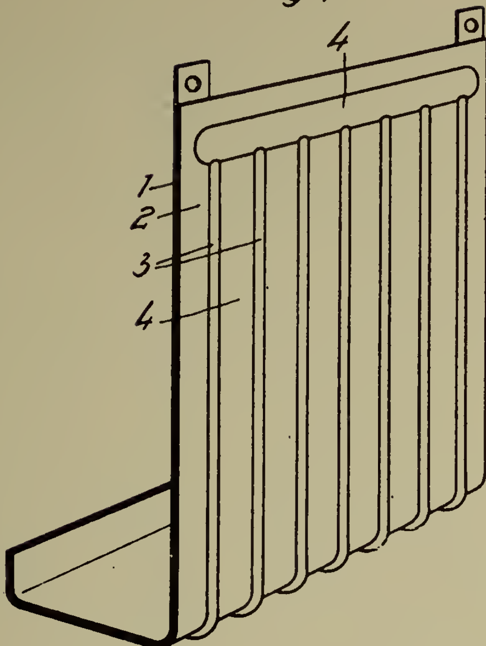


Fig. 2

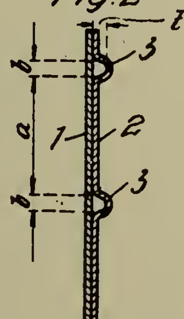
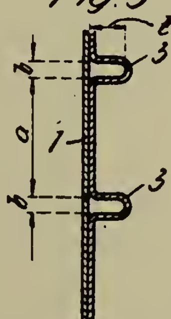


Fig. 3



Rudolf Hintze, Inventor

By his Attorneys

Published May 25, 1943 Serial No. 389,323

ALIEN PROPERTY CUSTODIAN

RECTIFIERS FOR VOLTAGE DUPLICATING CIRCUITS

Felix Herriger, Berlin, Germany; vested in the Alien Property Custodian

Application filed April 19, 1941

The present invention relates to rectifiers for voltage duplicating circuits and consists in certain features of novelty which will appear from the following description and be pointed out in the appended claims; reference being made to the accompanying drawing, in which

Fig. 1 shows the circuit diagram of a rectifier system known as the "Greinacher Circuit", while Fig. 2 is a longitudinal cross-section through one embodiment according to this invention.

Referring to Fig. 1 which shows a known rectifier system, reference numeral 1 indicates a first rectifier valve having a cathode 2 and an anode 3, while reference numeral 4 denotes a second rectifier valve including a cathode 5 and an anode 6. These two high tension valves or valve systems 1 and 4 are connected in series, that is, the anode 3 of the first valve system 1 is electrically connected with the cathode 5 of the second system 4. It has been proposed and readily realized to provide these two valve systems in one single discharge vessel common thereto. It has also been proposed in the past to combine the anode 3 and the cathode 5 in one unit, that is to say, in such manner that the anode 3 simultaneously serves as the supporting member for the electron emitting layer of the cathode 5. Such an arrangement which hereinafter will be defined as a "cathanode" is obviously advantageous since it does away with the otherwise necessary heating source which must be insulated against high tension voltages, but numerous technical difficulties have been encountered with respect to the design thereof. The essential reason for these difficulties resides in the fact that the anode surface facing the cathode is rendered active during operation, thereby causing electrons to flow in the blocking direction of the valve, that is, from the anode 3 to the cathode 2, with the result that the cathode is subject to destruction. Investigation carried out in the object to overcome this activation of the anode surface opposing the cathode have not yet led to the desired results.

It is an object of this invention to provide means which are capable of eliminating this undesired activation of the surface of the anode facing the cathode. This is realized according to the invention by the use of a cathode of thoriated tungsten or of tungsten which has been covered with a layer of thorium oxide. A cathode of the above mentioned kind operates at considerably higher temperatures than the cathodes heretofore employed for similar purposes, i. e. cathodes consisting of an oxide of a metal selected from the group of the alkaline earths.

The action of cathodes of thoriated tungsten or of cathodes of tungsten with a coating of thorium oxide will now be considered. During evaporation of the cathode activating substance, such as thorium, and the deposition of the thorium vapors on the anode, no substantial back-current is allowed to flow from the anode 3 to the cathode 2 since the suitable operating temperature of the cathanode is insufficient to cause an appreciable emission of thorium toward the cathode 2. The actual anode 3 must be so dimensioned that the cathanode by heat radiating from the cathode 2 assumes an operating temperature ranging between 750 and 800 degrees centigrade. During its formation, the thoriated tungsten or the thorium constituting the cathode must be heated to such a high temperature that the cathanode assumes a temperature at which the earths alkaline carbonates forming the coating of the cathanode are disintegrated into oxides.

It is an essential matter of design for the correct operation of this device that no vapor of barium may obtain access into the interior of the anode. The walls of the cathanode must be of such thickness that no diffusion of barium with the metal forming this member takes place. For example, if the cathode unit of the cathanode consists of nickel, the thickness of the walls must be in excess of .012 inch.

One embodiment of a device mentioned above is shown in Fig. 2, which shows a cathode 7 of thoriated tungsten in the shape of a helix. This cathode is surrounded by a cathanode 8 which is fully closed except the two narrow apertures 9 and 10 through which the leads of the cathode 7 project. This completly closed structure of the cathanode prevents vapors of earths alkaline metals from entering the interior of the cathanode. The coating of an earth alkaline oxide 8' is applied on the surface facing the anode 11 and consists preferably of a mixture of earth alkaline carbonates. The cathanode 8 has a lead-in conductor 12 and the serially connected further anode 11 is provided with a lead-in conductor 13. The discharge vessel enclosing the electrode system is shown at 14.

FELIX HERRIGER.

PUBLISHED MAY 25, 1943. BY A. P. C.

F. HERRIGER

RECTIFIERS FOR VOLTAGE DUPLICATING CIRCUITS

Filed April 19, 1941

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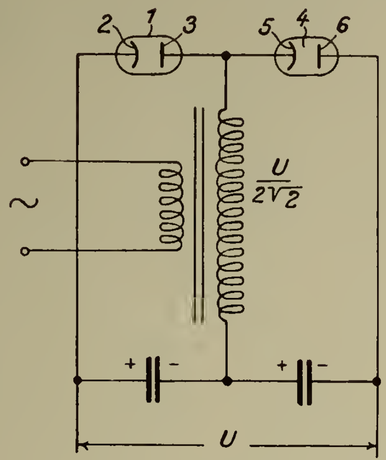

Fig.1

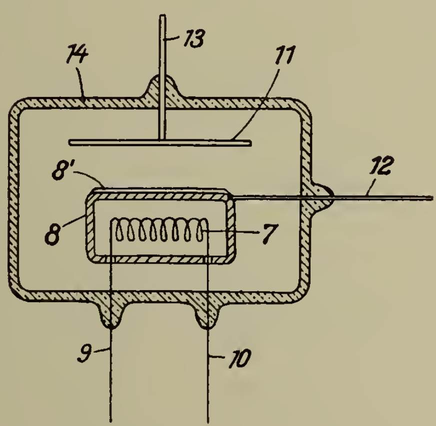

Fig.2

Felix Herriger

INVENTOR.

BY E. D. Phinney

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ALIEN PROPERTY CUSTODIAN

PROCESS AND APPARATUS FOR MANUFACTURING BURNT, MOLTEN OR CLINKERIZED MATERIALS AND PARTICULARLY CEMENTS

Pierre Coiffu, Paris, France; vested in the Alien Property Custodian

Application filed April 22, 1941

The use of rotary furnaces which are continuously fed with raw materials at the upper end and heated by a flame at the other end lead, particularly in the manufacture of cements, to the formation of an inner ring which progressively increases and finally obstructs the furnace.

The various known means for proceeding with the destruction of the said ring vary with the nature of the products being treated and the size of the furnace but all of them cause a deterioration of the refractory lining and frequent interruptions in the operation of the furnace.

It has also been attempted to delay the formation of the ring by different means. Thus, for instance, by modifying the composition and the state of the raw materials introduced in the furnace. Such means generally cause an irregular operation of the furnace, either in modifying the composition of the finished products obtained or by varying the heating process which consequently do not enable to secure a perfectly regular operation and combustion and thus an economical production.

The present invention has for its objects a process which enable to more effectively delay the formation of the said ring and even in some cases to prevent it without having the above mentioned disadvantages, and which consists in systematically bringing at different temperatures various spots of the furnace lining located in the usual region in which the said ring is being formed and in a same plane which is at right angles to the axis of revolution of the said furnace, so that the isothermal curves of the lining are not any more located, as is usually the case, substantially in planes at right angles to the said axis.

In a first embodiment of the said invention, the lining of the furnace, in the zone in which the ring is likely to be formed, is provided with arcs constituted by a material having a thermal conductivity which is higher than that of the adjacent arcs.

By way of example, Fig. 1 shows the section of a furnace according to the said embodiment.

The lining of the said furnace is constituted by two sectors of carborundum bricks 1, separated by two sectors of silico-aluminum bricks 2. The latter being of lower thermal conductivity, the corresponding furnace walls are hotter than the walls corresponding to the sectors 1.

In a second embodiment of the present invention, the furnace is provided in the region in which the ring is likely to be formed, with a non-circular section, i. e. a section in which some points are more remote than the others from the general axis of revolution of the furnace.

By way of example, the Figures 2 and 3 show two sections at right angles to each other of a furnace according to the said second embodiment.

The section of the said furnace is circular over most of the length of the furnace and is larger at 3 in the zone in which the ring is likely to be formed.

In such conditions, in the parts 3, which are most remote from the axis, is obtained a temperature which is lower than that prevailing in the parts closer to the axis.

In both abovementioned embodiments, the means for solving the problem suggested: i. e. the destruction of the rings, consist in special constructions of the furnace. The said means do not vary in a given furnace, whilst the position, shape and nature of the ring are at each time different. The remedy is thus not exactly adapted to the evil.

On the contrary, in the third embodiment described hereunder, the remedy may be varied according to the evil.

In said third embodiment of the present invention, a difference of temperature in the zone of formation of the ring is generated when it is desired to prevent the formation of the ring, by modifying the normal distribution of calories transferred to the lining by the heating device, for instance by stopping or slowing down the rotation of the furnace or by modifying the length of the flame of the heating device when one or more generatrixes of the furnace reach the highest position.

In such conditions, some generatrixes of the lining are brought at higher temperatures than the others, thus causing the destruction of the ring or preventing its formation.

It is, of course, possible to slow down the furnace several times at each revolution, said slowing down being always produced at the time at which one or more generatrixes of the furnace pass at the highest point. Full stopping for a very short time could also be provided at each revolution.

The mechanical embodiment of said controlled slowing down or stopping of the furnace only involves very simple mechanical or electrical problems, known by themselves. It would naturally be necessary to adjust the average speed of revolution of the furnace, so that its production will not be reduced.

PIERRE COIFFU.

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P. COIFFU
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Serial No. 389,810

Fig_1

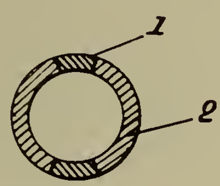


Fig_2

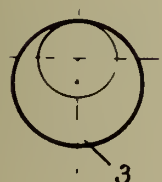
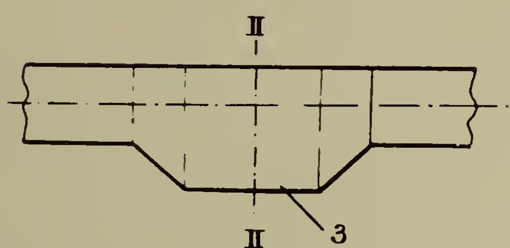


Fig_3



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ALIEN PROPERTY CUSTODIAN

PARACHUTE EQUIPMENT

Ákos Hehs, Szekesfehervar, Hungary; vested in the Alien Property Custodian

Application filed April 24, 1941

It is well known that, when making descents by parachute from aircraft flying at high speeds, it is possible that the opening of the parachute will result in inadmissibly high forces of inertia being set up, which will endanger the safety of the parachutist and cause damage to the parachute. As regards the parachute, an additional point that has to be taken into consideration is that during the period of its opening the parachute will constantly alter its shape so that it is not possible to make provision for the uniform distribution of the load during that period, and that therefore the parachute may suffer damage in those cases also when the descent by parachute is effected at such flying speeds as would in other respects be permissible for the parachute.

Experience has shown that the body of a healthy human person will bear, without suffering any injury, positive or negative accelerations of a certain magnitude, for instance negative accelerations by which its initial velocity is reduced, within the few seconds of descent, to between ⅙th and ⅐th of its original figure. These accelerations are determined by the forces set up when the parachute opens. It is well known that the magnitude of these forces may be computed from the load multiple, the formula of the latter being the following:

$$T=\frac{v-v_s}{g.t}+1$$

In this formula v is the speed of the aircraft at the moment when the parachutist takes the leap, v_s the velocity of descent of the parachute, which in general amounts to 6 metres per second, g the gravitational acceleration=9.81 m/sec^2 and t the time required for the parachute to open and for the velocity of the parachutist to be braked in the total extent required, the said time amounting, generally, in the case of a specific load of the parachute of 2 kilograms per square metre, to 2 seconds. From this well-known formula, the highest aircraft speed permissible for effecting descents by parachute results at the figure of roughly 238 kilometres per hour. It follows herefrom that at flying speeds slightly exceeding 250 km per hour, descents by parachute with automatic release of the parachute can no longer be effected with the desired degree of safety for the parachutist and may only be effected with release by hand. On the other hand, the training of the crews for this last-named method of descent by parachute requires a great deal of time and therefore this method is one which as a rule is not directly available. On the other hand it is in most cases not feasible to reduce the flying speed at the moment when the parachutist takes the leap to the figure of about 250 km per hour indicated above.

The purpose of the invention is to eliminate this drawback. For this purpose there is provided in the parachute equipment according to the invention, in addition to the usual large cap, at least one braking surface of smaller size, and this surface is arranged and dimensioned in such a manner as to cause it to come into action before the large cap opens, thereby reducing the high initial velocity of the parachutist to a figure admissible from the point of view of the sudden load it will cause to be placed on the main cap.

The load, consisting of one great shock produced in the case of the usual type of parachute comprising one single cap only, will owing to the arrangement referred to above be divided into two consecutive smaller loads between which, moreover, a braking effect will be exercised, so that the total of the two loads will be smaller than the load which would be set up in a parachute of the type used up to now. The appropriate dimensioning of the braking surface coming into play first will, on the other hand, even at the highest flying speeds which it has been possible to reach up to now, enable both shocks to be reduced to such figures as will not endanger either the parachute or the safety of the parachutist.

Preferably the additional braking surface and the main cap will be mutually connected in such a manner that the complete opening of the braking surface should at the same time cause the closing device of the main cap to become released, such release being effected by positive motion. As the additional braking surface will continuously retard the velocity of descent, the main cap will unfold more slowly than it would in the known types of parachutes. Tests have shown that the time, amounting to about 4 seconds, required for the full opening of both caps is sufficient for causing the velocity of descent and thereby the load multiple to be reduced in such an extent as to place no detrimental stresses on the main cap, and for weakening the second shock also in such an extent as to ensure that it will not endanger the safety of the parachutist.

Release by hand may, however, be provided for the main cap instead of release, effected through

positive motion, by the additional braking surface. In this case a further reduction of the load multiple and thereby of the shock produced may be obtained by an appropriately retarded release of the main cap. This will result in the important advantage as compared to the usual type of parachutes that at the time when the main cap is being released by hand, the descent of the parachutist will owing to the effect of the additional braking surface take place in the vertical direction, almost without any oscillation or pendulum movement.

It will be advantageous to employ grappling-ropes of a short length only for the additional braking surface, which latter should preferably be constructed in parachute form likewise, and to provide a rope between the said grappling-ropes and the harness of the parachutist, the length of the said rope being approximately equal to that of the grappling-ropes of the main cap. This will assure the unhampered unfolding of the main cap and will prevent any entanglement of the grappling-ropes of the main cap with those of the additional braking surface.

An embodiment exemplifying the parachute according to the invention is represented on the accompanying drawing.

Fig. 1 shows the parachute equipment mounted on the back of the airman.

Fig. 2 represents the stage at which the additional braking surfaces has already opened.

Fig. 3 shows the caps in the opened condition during the descent.

Fig. 4 shows the arrangement for releasing the main cap by hand.

Figs. 5 to 16 show the operation of the parachute equipment according to the invention from the moment when the leap is taken up to the moment at which the main cap has opened completely; notably Figs. 5 to 10 show the whole equipment with the parachutist, whilst Figs. 11 to 16 show details, particularly the containers, in the various stages during the descent.

The main cap is encased in the usual way in the pocket 1, whilst the additional braking surface is encased in the pocket 2, located above the pocket 1. The releasing cord 3 of the pocket of the additional braking surface is fixed, coiled in its greatest part, in an easily detachable manner on the back of the pocket 1 and is hooked into the airplane by means of the snap-hook 13. When the leap is taken, the releasing cord 3 will open the closing device 4, of the usual type, of the pocket 2, so that the additional braking surface 5 (Figure 2), which in the example assumed is constructed in the form of a small-sized parachute, will unfold. The grappling-ropes 6 of the cap 5 are connected, across a thimble 7, with the rope 8, the length of which is approximately equal to that of the grappling-ropes of the main cap. The rope 8 is, at its lower end, connected, across the thimble 9, with the harness of the parachutist.

On the left-hand loop of the strap 10 of the harness the releasing cable 11 for the pocket of the main cap is fixed in such a manner that when the strap 10 is stretched this will cause the closing device of the pocket of the main cap to be opened through the releasing cable 11, so that the main cap 12 will open likewise. This transitional condition existing before the opening of the main cap is represented on Fig. 4, in which 11 denotes the releasing cable of the main cap. The braking cap has already opened, the additional braking surface 5 assuming the oblique position shown on Fig. 3. The area of this additional braking surface is substantially smaller than that of the main cap 12; the mutual proportion of the two may be, for instance 4 to 36; in this case the axis of the additional braking surface will during the descent deviate laterally at an angle of about 45 degrees from the vertical direction. This additional braking surface will thus exert a damping or steadying influence on the whole system, particularly it will damp the oscillating or pendulum motion, thus enabling the total surface area of the two caps to be chosen at a smaller figure, for the same velocity of descent, than with the types of parachute known up to now. Figs. 5 to 16 show the automatic operation of the parachute equipment. Fig. 5 illustrates a moment immediately following the taking of the leap, at which moment the releasing cord 3 becomes tensioned, whereupon the pocket 2 becomes torn open and the braking surface 5 is released, as shown on Figs. 5 and 6 as well as on Figs. 11 and 12. The grappling-ropes 6 of the braking surface 5 are becoming tensioned and are extracting the rope 8 from the pocket 2. After the rope 8 has become tensioned, the strap 10 also becomes tensioned, (Fig. 7). The fact of the strap 10 becoming tensioned will, through the releasing cable 11 (Fig. 13), cause the pocket 1 of the main cap 12 to become torn open. The main cap 12 escapes from the pocket (Figs. 8 and 14), the grappling-ropes 14 of the main cap become tensioned and the strap 15 connected with these grappling-ropes will likewise be torn out from the pocket 1 (Fig. 9). After both caps 5 and 12 have opened (Fig. 10), the two straps 10 and 14 will also have become tensioned (Fig. 16).

If it is desired that the main cap should be opened by hand and not automatically by the braking surface, the releasing cable of the main cap will not, as shown on Fig. 13, be connected with the strap 10 of the braking surface, but will, as shown on Fig. 4, be conducted, in a manner per se known, inside a metal tube 6 over the shoulder of the parachutist to his breast side.

Another important advantage of the equipment according to the invention consists in that, as soon as a very short time will have elapsed after the opening of the additional braking surface, the parachutist will continue his descent in the vertical direction. When effecting descents by parachute in groups e. g. in the case of parachute troops) and releasing the main cap by hand, this arrangement will enable the parachutists to fix their attention on the commander and open their caps simultaneously, which method of procedure will result in a substantial reduction of the degree of dispersion.

It follows from what has been said above that the equipment will enable safe descents to be effected also in case of high flying speeds and in case the aircraft has descended to a low level in approaching its object.

The invention is of course not limited to the employment of one single additional braking surface. It would, for instance, also be possible that braking surfaces, opening when the leap is taken, should be provided on both shoulders of the parachutist.

AKOS HEHS.

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A. HEHS
PARACHUTE EQUIPMENT
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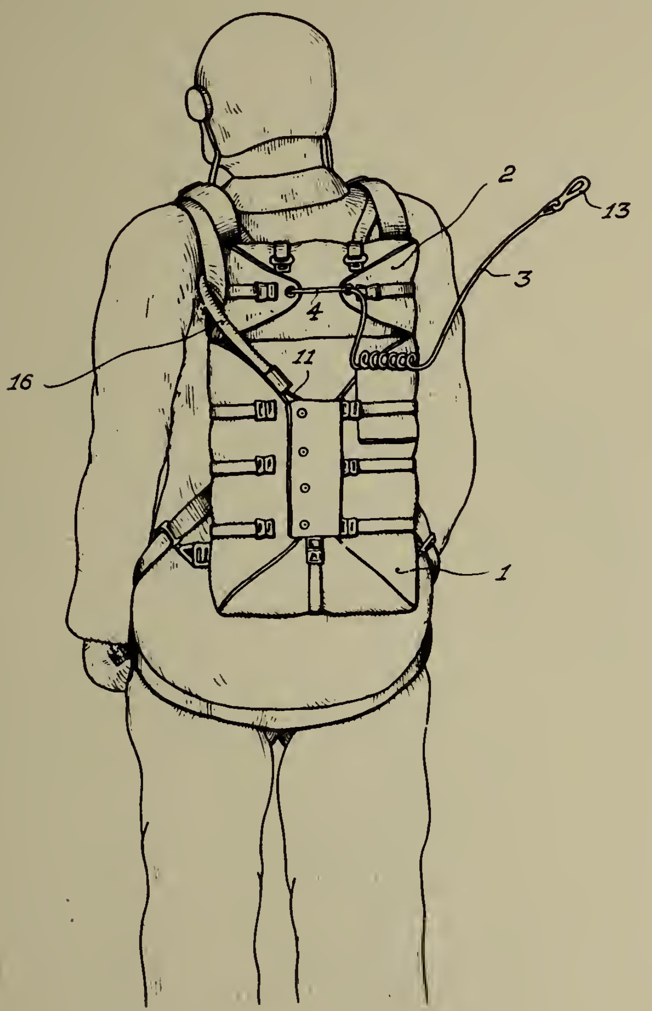

Fig. 1.

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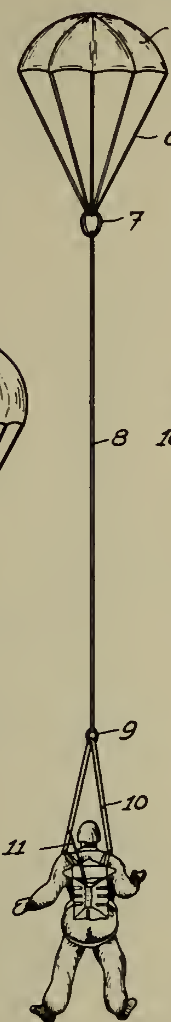

Fig. 2.

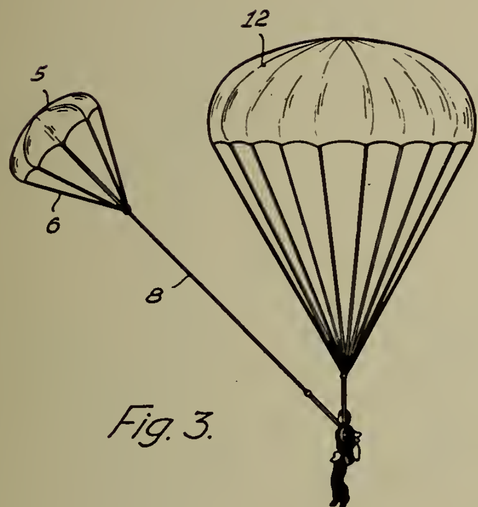

Fig. 3.

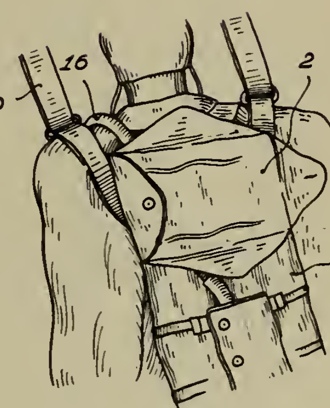

Fig. 4.

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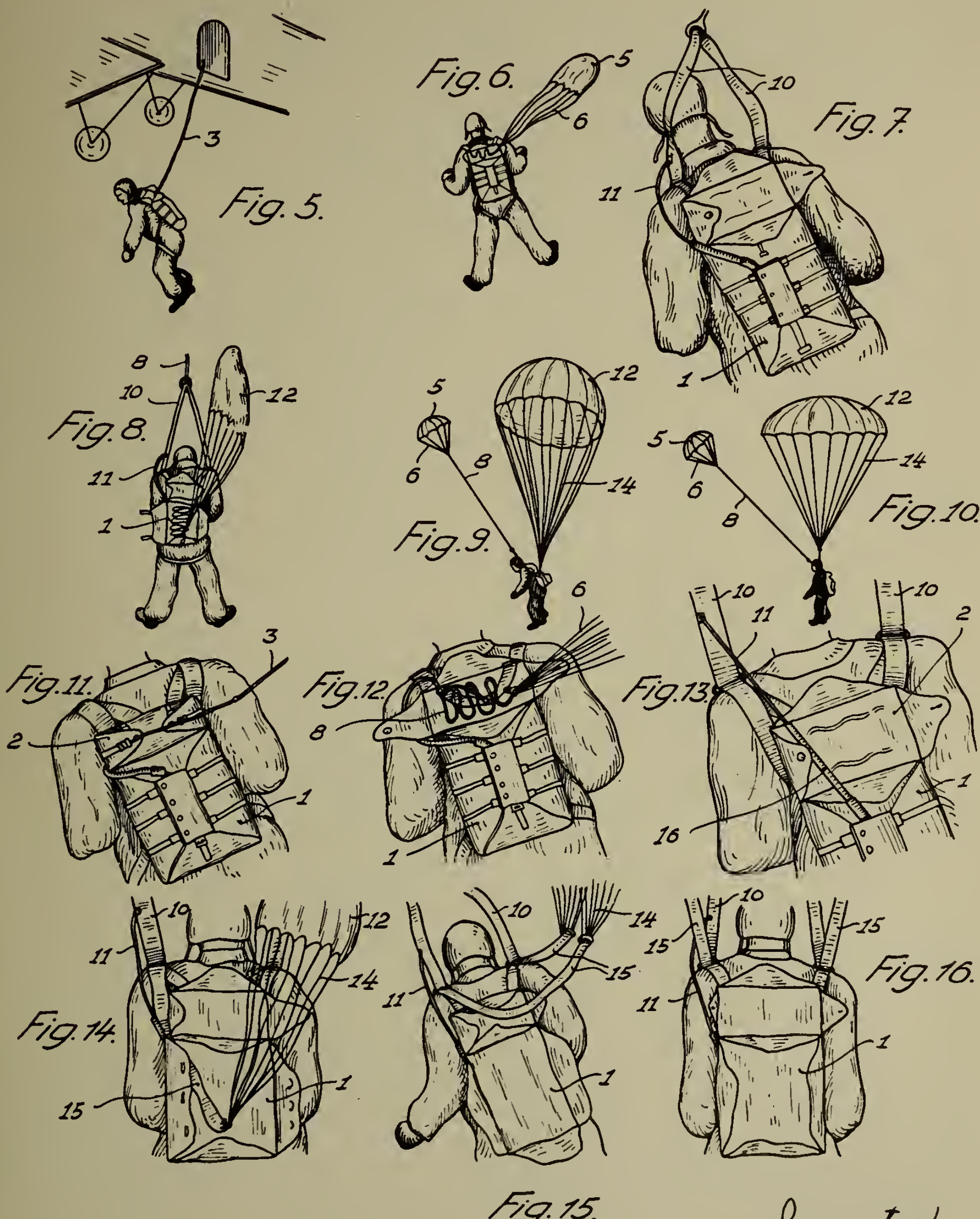

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ALIEN PROPERTY CUSTODIAN

MOTORCYCLE SPRINGING

Eric Latscher-Latka, Vienna, Germany; vested in the Alien Property Custodian

Application filed April 21, 1941, Serial No. 390,182

The problem of springing the frame of motorcycles by means of turnsprings has thus far not brought about any satisfying solution, in spite of the fact that turnsprings, as compared with the mostly used screwsprings, enjoy essential advantages. With turnsprings a special suppression of oscillation will be necessary. Furthermore, the springs arranged in couples are subjected to an unequal fatigue, which will cause one-side settlings. The employment of turnrodsprings, known by the construction of motorcars, forbids itself with single-line vehicles in consequence of the small breadth, which will enable not even to insert approximately sufficiently long springs. It was, therefore, endeavoured to use as turnsprings correspondingly strong cylindrical pieces of caoutchouc, which again, however, can apparently not possess any sufficient vitality.

It is now the purpose of this invention, to improve the motorcyclespringing process thus that, to obtain that effect, those turnsprings will preferably be made use of, which possess a suppressed oscillation and are fitted on springlevers, rulers or ruling parallelograms influencing the wheel to be springed. In a particular execution the invention makes use of such in themselves known laminary turnsprings, there the laminas, fitted around the turnaxles of the springs, may be swung with their endpoints around axles radially or approximately radially fitted to the turnaxle, so that the laminas will—i. e. each lamina in itself—be equally strongly be strained essentially only on turning. Such laminary turnsprings, in consequence of the multitude of laminas, possess an increased security against breaking and, in consequence of the friction between the single laminas, a very good suppression thus, that additional suppressing devices will not become necessary.

In the sketch, the invention is being described by means of samples of execution.

Fig. 1 shows the profile view and Fig. 2 the front view of a four wheel swinging. The Figs. 3 and 4 show two different executions of the hindwheel swinging in a profile view. Fig. 5 shows an intersection view on the arrow direction, as shown in Fig. 4.

With the handlebar axle 2, borne in the handlebar bearing (Figs. 1 and 2), are connected the eyepieces 3 and 4 bearing the swing levers 5 and 6 which, together with the forewheel fork 7 form a ruler parallelogram. The swing lever 6 encroaches on the turnswing axle 8. The turnswing could as well be provided for in another one of the four jointpoints, on turnsprings also in several jointpoints. The turnspring, in section partly described in Fig. 2, consists of the central axle 9, on the ends of which encroach the swing levers 6. The axle 9 is borne in the forepieces 7. Firmly wedged upon the axles is the circular piece 10, possessing on itself oblong slits 11, into which encroach from a ring 12 the turnpins 13 for the ends of the spring laminas 14. The other lamina ends are rotatorily fitted around turnpins (not described), which sit in the circular piece 15, which is in an appropriate manner firmly connected with the tubelike casing. The casing 16 is rotatorily borne on the forecheeks 7, 7. On the shell, there is adjusted a ring 18, formed in the manner of a crownnut, by means of which the ring 17 and the shell 16, through insetting a thorn used as a lever, may be twisted against the turning effect of the spring laminas. A springbolt 19 serves in order to fix the relayed spring. With the change of the relay of the spring this will be adapted to the loading of the foreaxle, respectively slackenings of the spring may be compensated.

To perform a springing of the hindaxle, by way of example, as is shown in Fig. 3, the hindwheel-axle, supported by a linkparallelogram 20, 21, 22, 23, into the one link of which is fitted the turnspring 7. There may naturally also in other linkpoints, for instance between the links 20 and 21, turnsprings be provided for. The rulers 23, in the present example, are fitted upon the shell 16 (Fig. 2), and may be swung with this, whereas the axle 9 may be turned by means of the lever 27 in the cheeks 26, connected with wheelblock 25, and be fixed by means of bolttacks 28 or such like devices, whereby the relay of the turnspring may be changed and adapted to the, for the time being, loading of the hindwheel. The turnspring 7, as is shown in Figs. 4 and 5, may also be fitted in the hindwheelaxle, so that the springlever may be adjusted in whatever shortness as may be liked, while it supports itself on the outriggers 31, 32 of the frame with its free end 24.

To such purpose the outriggers 31, 32 are supported one against the other by means of a connection piece, consisting in two pieces 35 and 36. The two pieces 35 and 36 are flexibly connected with one another on the spot of the swinglever-link 34 through a bolt, which is common for these pieces and the linklevereye, and receives its stiffness by sliding on the shoes of these linkpieces upon the outriggers 31 and 32. The flexible connection of the pieces facilitates the sliding on. The hindwheel runs in ball-bearings upon the shell 7 of the turnspring. On the shell, there sit

the turnlevers **30**. The axle of the turnspring is secured against turning by help of the levers **37**, which are slideably conducted in conducting liners **38**, which are flexibly borne on the curvepiece **36**.

In order to take off the hindwheel, for instance, when there has happened some damage to the tire, the nuts **39**, holding fast the curvepiece **36** upon the outrigger **32**, will be screwed off and the linkbolt **34** drawn out so far, that the piece **36** and the springlever **30** will become free of the shoe **35**, but still remain in contact with one another, so that the levers **30** and **37** are kept in their position towards the turnspring-relay by aid of the curvepiece **36**. The curvepiece **36** may be swung around the link **34**, so that within certain limits, the position of the curvepiece end on the outrigger **32** under its elastic compliance and thus the relay of the turnspring may be changed by altering the nuts **39** and **40**. Also the shoe **38** on the curvepiece **36** may be fitted flexibly. Instead of bearing the lever **37** slideable, in case that the tunrspring was placed to the hindaxle, the levers **30**, **37** may also, similar to, as it is shown in Fig. 3, but with a considerably shorter length of lever, form with the respective rulers a rulerparallelogram.

In an obviously equal way the bearing, according to the invention, may naturally also be adopted with ordinary bicycles.

ERIC LATSCHER-LATKA.

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MOTORCYCLE SPRINGING

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4 Sheets-Sheet 1

Fig. 1

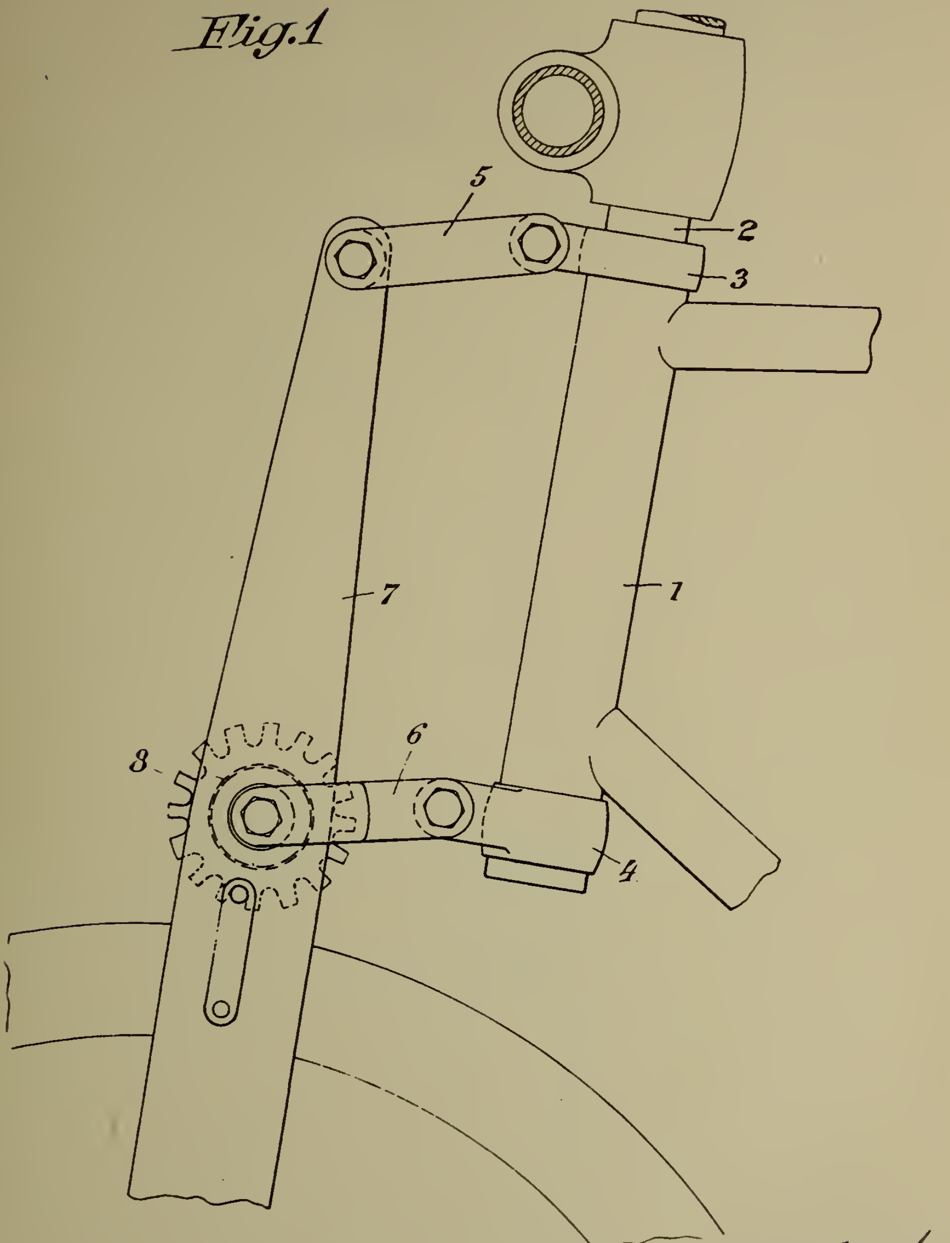

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Fig. 2

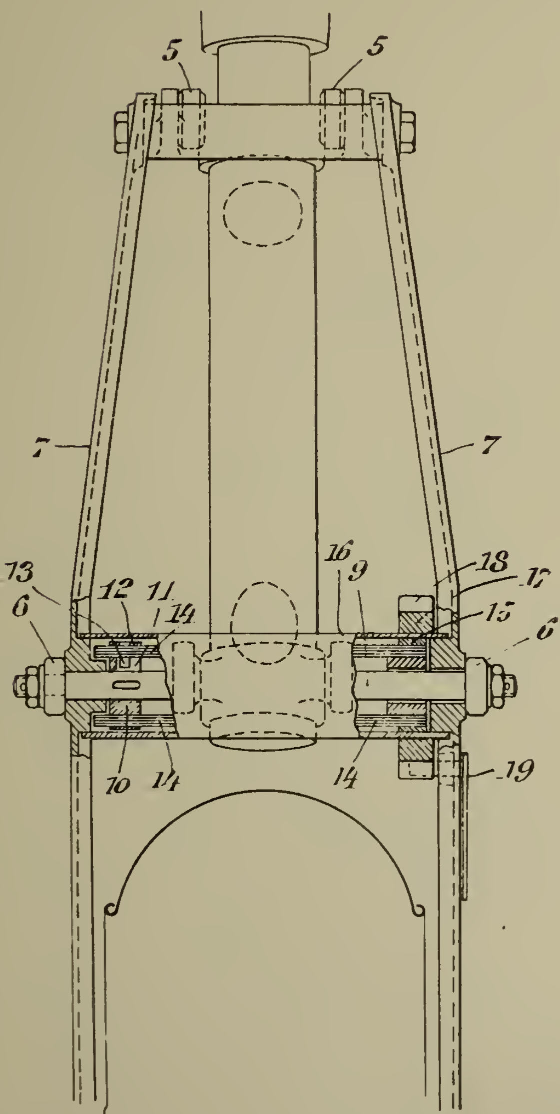

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Fig. 3

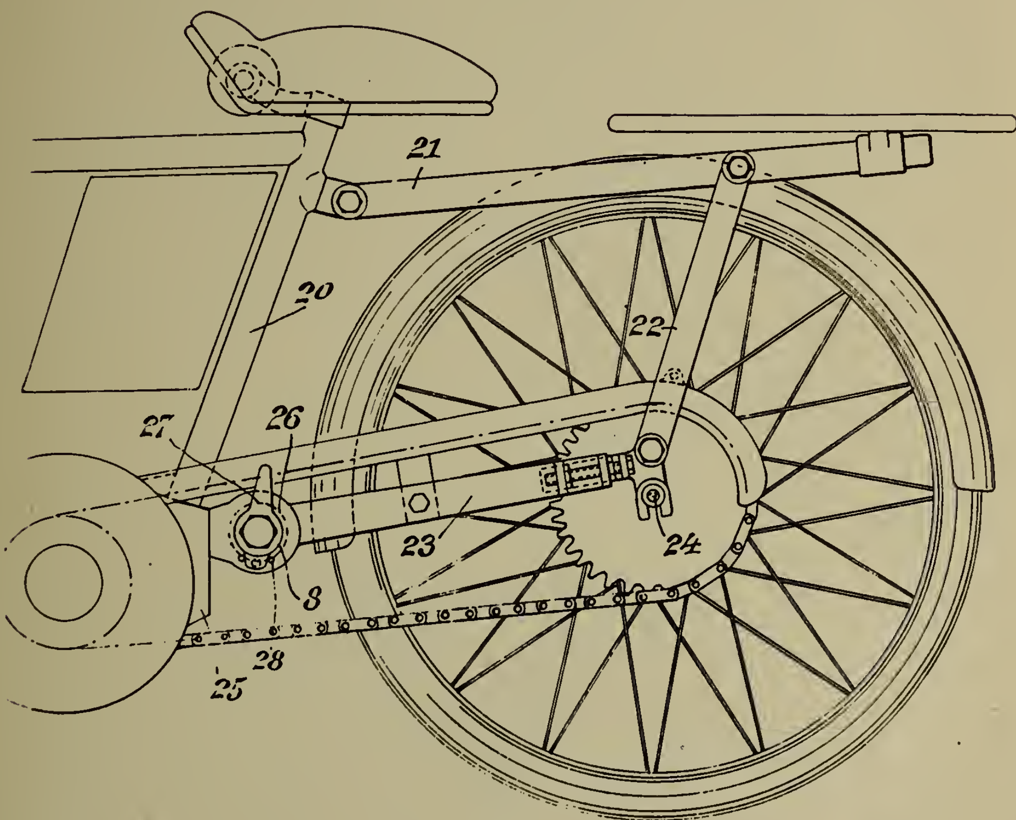

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Fig. 4

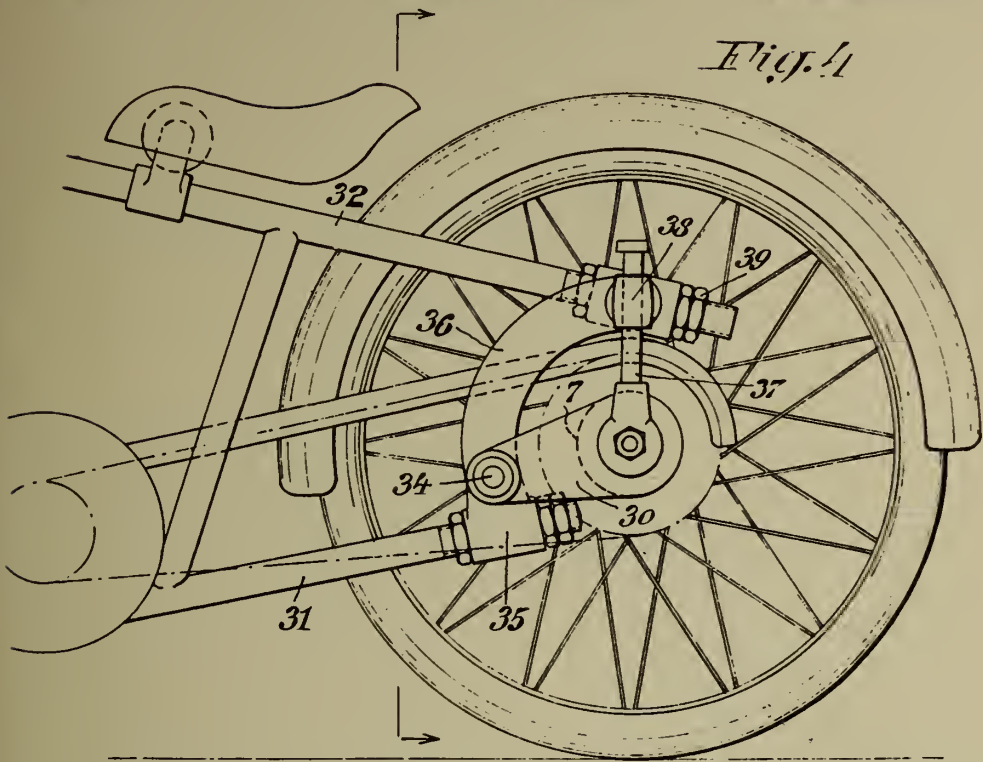
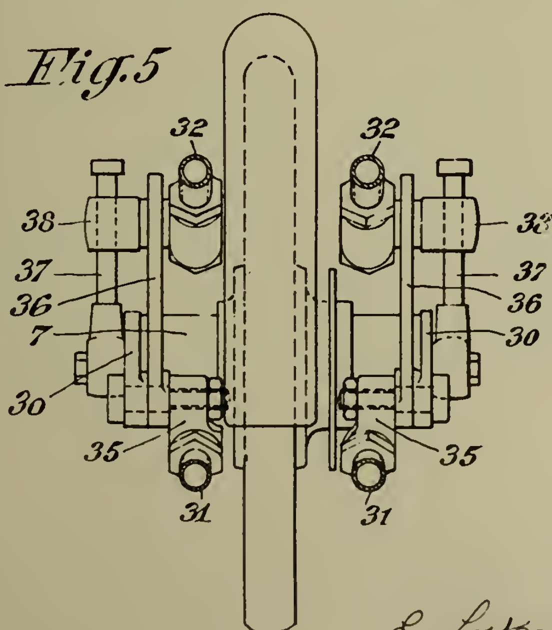


Fig. 5



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ALIEN PROPERTY CUSTODIAN

ELECTRIC VACUUM CLEANER

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vested in the Alien Property Custodian

Application filed April 29, 1941

The invention relates to an electric vacuum cleaner the fan or fans of which being mounted in a fan housing which is closed by a cover and whereby the air is sucked through an aperture in the cover of said fan housing and through the dust collector which is arranged before the said aperture. The invention relates more especially to the construction of such a cover for a fan housing of an electric vacuum cleaner.

With the well-known vacuum cleaners of this type it appeared that it often occurred that the dust collector was sucked into the aperture in the fan housing cover so that the said aperture was closed. It has been tried already to remove this drawback by filling the aperture in the cover with a grid. Also in that case it still occurred that said aperture was entirely closed by the dust collector, which was sucked against said grid.

The cover according to the invention is characterized in that in front of the aperture in the cover a number of protruding ribs are arranged which, even if the dust collector is sucked against said ribs, let free lateral air channels, so that the suction action is always maintained. The ribs are preferably arranged parallel to each other at a small mutual distance and the cover with said ribs is mounted in a vertical position on the fan housing.

The invention is elucidated by an embodiment along the lines of the drawing.

Figure 1 is a section of a vacuum cleaner which is provided with the fan housing cover according to the invention.

Figure 2 is a front view of said cover.

In the drawing **1** is the vacuum cleaner housing in which an electromotor **2** with a fan **3**, contained in a fan housing **4**, is resiliently supported by a rubber support **5** and a rubber ring **6**, which is arranged around the fan housing. In front of the fan housing **4** the dust collector **7** is arranged. The fan housing **4** is closed by the cover **8** according to the invention. This cover **8** has a central suction aperture **9** and before said aperture there are some, in the present case three, parallelly arranged ribs **10**, protruding from the front of the aperture **9**.

If during the operation the dust collector **7** is sucked against the cover **8** always two channels **11** and **12** will be left free at either side of the aperture **9**, through which channels the sucked-in air may enter. The ribs **10** are preferably arranged vertically, since in that case the dust collector, becoming flat if the vacuum cleaner motor is switched off, will slide down along the ribs **10**, so that there is no possibility, as with horizontally arranged ribs, that the dust collector would be kept pending between the ribs by which an air channel would yet be closed.

Preferably the cover is made of Bakelite or a similar artificial resin press material. Said material has the advantage that a smooth surface is obtained which is not subject to alterations so that the very small friction coefficient is maintained which by nature is present.

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Fig. 1.

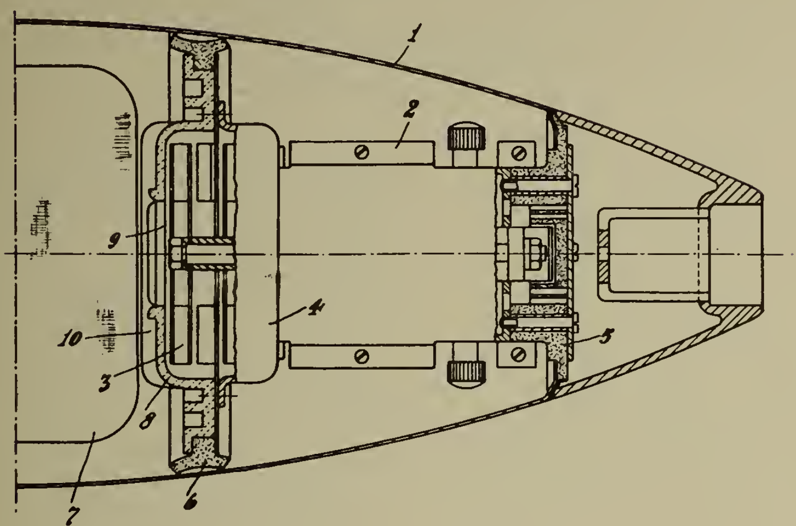
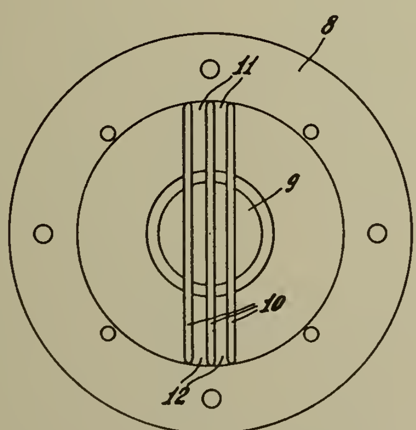


Fig. 2.



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BOOKING MACHINES, ESPECIALLY TYPEWRITING - CALCULATING MACHINES EQUIPPED WITH TOTAL-TAKING MECHANISM

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Application filed April 30, 1941

This invention relates to booking machines, especially typewriting - calculating machines equipped with total-taking mechanism.

In known machines of this kind, selection of the multiplicand- and mulitplicator places of a multiplying mechanism was done electrically, but owing to the sensitiveness of electrical transfers, trouble has been experienced quite often with machines of this kind.

According to the invention these disadvantages are eliminated by means of a coupling device controlled in dependence of the paper carriage for decimal switching of a transfer member driven by the total-taking mechanism for entering the factors in the factor place and for taking the product from the product mechanism.

In the accompanying drawings one form of carrying out the invention is shown by way of example, viz:

Fig. 1 shows a perspective view of a typewriting-calculating machine including the device according to the invention,

Fig. 2 shows a left-hand side view of the typewriting-calculating machine, the housing and some parts being shown broken off or broken out.

Fig. 3 shows a plan view of a part of the paper carriage and the multiplying mechanism of the typewriting-calculating machine, in which for better display some parts are broken off or out and the parts are shown in rest position.

Fig. 4 shows a perspective view, as viewed from the right front of the machine, of the coupling device of the paper carriage, and part of the coupling rods according to Fig. 3, some parts being drawn apart telescope-fashion for better illustration.

Fig. 5 shows a plan view of a section of Fig. 3, upon an enlarged scale.

Fig. 6 shows the coupling connection between the paper carriage and the coupling rod system in the direction of carriage movement.

Fig. 7 shows the parts according to Fig. 6 during the return of the carriage.

Fig. 8 shows a section of Fig. 2 upon an enlarged scale.

Fig. 8*a* shows a perspective view of individual parts according to Fig. 8, viewed from the right rear of the machine, these parts being drawn apart telescope-fashion for better display.

Fig. 9 shows a perspective view, as viewed from the left front, of the gears between the coupling rods and the small wheel registering the values in the multiplying mechanism.

The Figs. 10 to 18 show in schematic view various positions of the device in accordance with the invention, as follows:

Fig. 10 shows that position in which on tabulating the driving connection is established between the paper carriage and the device according to the invention, for the purpose of entering the multiplicand.

Figs. 11 to 13 show the positions before, during and after the skipping of the comma position when entering the multiplicand.

Figs. 14 to 16 show the positions before, during and after the skipping of the comma position when entering the multiplicator, and

Figs. 17 and 18 show the positions before and after the comma position during the product total-taking.

General-description

The present device according to the invention is for use on a typewriting-calculating machine with automatic total-taking device, which besides the conventional species (addition, subtraction) is also equipped for multiplication. A multiplying mechanism 1 (Fig. 3) suitable for forming the product from two factor values is preferably mounted on the left beside the machine frame 2. The factor values are suitably entered by decimal places in gear systems provided for this purpose within said multiplying mechanism 1 (multiplicand gear 3 and multiplicator gear 4) by way of the conventional calculating keys 5 (Fig. 1) depressed during normal calculations (addition and subtraction) and by means of the customary total-taking device (not shown). These processes have been described in detail in the Patent ——— (Patent application Ser. Nr. 338,272, filed May 31, 1940) and therefore need not be further explained here.

The entry by decimal places of the factor values into the multiplying mechanism 1 (Fig. 3) and after their product has been computed the removal of the product value from the multiplying mechanism 1 is effected by way of a registering wheel 6 (Figs. 2, 3, 8). The latter is mounted to slide but not to revolve on a shaft 7 driven by the total-taking mechanism of the typewriting-calculating machine and is set by the mechanism according to the invention in dependence of the paper carriage movement with respect to the gear wheel of one of the chain of gears 3 or 4 (Figs. 3 and 3) corresponding to the decimal place selected during the tabulating of the paper carriage 8. The gear system 3 consists of eight wheels arranged in parallel by decimals by means of which any desired multiplicator

is entered by decimals into the multiplying mechanism.

The device according to the invention is arranged as follows:

Arrangement of the coupling device—

As is known, in order to limit a left-hand movement of the paper carriage 8 which has been started by depressing the respective tabulator key of a decimal tabulator keyboard 9 (Fig. 1), corresponding tabulator riders are set on a tabulator rider bar 10 (Figs. 2 to 4) arranged on the rear section of the paper carriage 8. A similar tabulator rider is also set on the rider bar 10, opposite the column totalizer 12 intended for storing the multiplicand value, in such a way that as soon as the column totalizer 12 with its comma position K (Fig. 10) moves into operating position, the rider 11 by its lug 154 (Fig. 4) will positively release the paper carriage 8 to move one step towards left so that automatic skipping of the comma is effected. A similar rider 13 is mounted on the left, as viewed from the front of the machine, beside this tabulator rider 11 at a distance marked *a* in Fig. 10. The distance marked *a* which is limited on one side by the driving gear A of the calculating mechanism of the machine and on the other side by the highest calculating place of the column totalizer 12 storing the multiplicand, corresponds to the distance *b* reaching from the place M of the multiplying device controlling the multiplication as far as the highest place of the multiplicand gear system 3. It should be noted, however, that latter rider 13 does not cooperate with the decimal tabulator device of the typewriting-calculating machine.

A coupling hook 14 is screwed to said rider 13 by means of a screw 13*a* (Fig. 4). This hook 14 at its upwardly and rearwardly bent portion has a coupling edge 15 as well as a second coupling edge 16 which is recessed towards right by one shifting step of the paper carriage. The edge 15 during the tabulating into the operating position of one of the calculating places of the column totalizer 12 to the left of the comma position K engages a lug 17 of a pawl 18 whereas this lug 17 of the pawl 18 is engaged by the lug 16 of the coupling hook 14 during the comma skip, and as the calculating places of the column totalizer 12 to the right of the comma position K are moved into operating position.

Opposite the column totalizer 19 for storing the multiplicator value, another tabulator rider 20 (Fig. 3) corresponding to the rider 11 is set on the tabulator rider bar 10 in such a way that as soon as the totalizer 19 with its comma position moves into operating position, the rider 20 with its lug 20*a* will positively start a shifting step of the paper carriage 8 towards left for the purpose of automatically skipping the comma position. A coupling hook 22 is fixedly screwed to this tabulator rider 20 by means of a screw 21 in such a way that its coupling edges 23 and 24 can also cooperate with the lug 17 of pawl 18. The pawl 18 (Figs. 3 to 5) is mounted to swing on a projection 26 of a slide 27 by means of a screw 25. The slide 27 is mounted to slide horizontally on a U-shaped supporting bridge 28. For this purpose a headed screw 29 screwed into the supporting bridge 28 projects through a longitudinal slot 30 of the slide 27 and another headed screw 32 screwed into a supporting member 31 (Fig. 3) extends through a longitudinal slot 33 of the slide 27. The slide 27 suitably comprises two parts which can be adjusted by means of screw-slot connections 34, 35 to form an integral unit. One end of a tension spring 37 is fastened to a pin 36 which is riveted in the slide 27. The opposite end of said spring is hooked in a suspension bar 38 which is fastened to the supporting bridge 28. This spring 37 constantly tends to move the slide 27 towards right (arrow 39) which movement is limited by the right end 40 (Figs. 3 and 4) of slide 27 striking against a rubber stop 41. The rubber stop 41 is fastened in a metal box 42 which by means of screws 44 protruding through its downward extended arm 43 is screwed to the supporting bridge 28. This bridge is itself mounted on the rear supporting bar 2*a* of the machine frame 2 by means of screws 23*a*. A locking pawl 46 is mounted to swing on the right arm of the abovementioned pawl 18 (Figs. 3 and 5) by means of a riveted pin 45. The locking pawl 46 supports one arm of a torsion spring 47 which is coiled around a screw 48 threaded into the pawl 18 and constantly tends to move the pawl 46 anticlockwise around the riveted pin 45. When the slide 27 is in rest position, however, (Figs. 4 and 5), a pin 49 which is riveted into the locking pawl 46 is supported by a bevel 50 of a control member 51 thus preventing any further movement of the locking pawl 46. If, however, this locking 49, 50 is released, as will be described later, the torsion spring 47 moves the locking pawl 46 anticlockwise around the riveted pin 45 so that the front edge 46a of the pawl 46 will strike against a stop pin 52 riveted into the slide 27. In this position the locking pawl 46 by means of its slanted edge 53 can cooperate with one of the chamfered edges 14*a* or 22*a* of the coupling hooks 14 or 22. The control member 51 is screwed to the supporting bridge 28 by means of screws 54.

The right end 55 of the locking pawl 46 is shaped like a hook from which the longer arm 56 of a torsion spring 57 is suspended. The torsion spring 57, which is coiled around a screw 58 threaded into the slide 27 and by means of its short arm protrudes into a bore-hole of the slide 27, tends to move the locking pawl 46 anti-clockwise around the riveted pin 45. Owing to the lock 49, 50, pawl 46 cannot participate in this movement, so that the tendency of the torsion spring 57 will be transferred to the pawl 18 by way of the rivet connection 45, 18, causing the latter to swing anticlockwise around the screw 25 until in its rest position the pawl 18 by its rear edge 60 strikes against a pin 61 fastened in the slide 27.

The pawl 18 also has a slanting edge 62 which when entering the multiplicand, at the moment of skipping the comma position K (Figs. 11 and 13) provided in the column totalizer 12 storing the multiplicand, cooperates with a pin 63 (Figs. 4 and 5) and, after the entry of the multiplicand has been completed, with a pin 64. Both pins 63 and 64 are fastened in a supporting member 66 screwed to the supporting bridge 28 by means of screws 65 and are spaced from each other by the distance of two shifting steps. When entering the multiplicator, the slanting edge 62 of the pawl 18, at the moment of skipping the comma position provided in the column totalizer 19 storing the multiplicator, engages a pin 67, and after the entry of the multiplicator has been completed, a pin 68. These pins 67 and 68 are arranged in the same manner as the pins 63 and 64 but are fastened in a flap 69 mounted to swing, whereas its pins 67 and 68 whilst the flap is in rest position are outside of the pathway of the edge 62 of the pawl 18, as will be hereinafter explained. The

flap 69 is screwed on a shaft 71 by means of screws 70 and said shaft 71 is mounted to revolve in two supports 72 and 73 fastened on the supporting bridge 28. A lever 75 is also rigidly mounted on the shaft 71 by means of a hub 74. A spring suspension pin 76 is riveted to said lever 75, and engaged by one end of a spring 77 whose opposite end is suspended from a pin 78 fastened in the supporting bridge 28 and influences the members 75, 71 and 69 in the direction of arrow 79 until in its rest position a lug 80 of lever 75 strikes against the rear edge 28*b* of the supporting bridge 28. Suspended from the pin 76 of the lever 75 is another spring 81 which with the other end is fastened to a pin 83 riveted to a locking lever 82. The locking lever 82 is mounted to swing on the shaft 71 by means of a hub 84 and is constantly influenced around the shaft 71 in the opposite direction of arrow 79 by the above-mentioned tension spring 81 until in the rest position its catch 85 strikes against the pin 76. The locking lever 82 is also provided with a back-catch 86 which at the right moment is capable of cooperating with the right front edge 87 of a lug 88 mounted on the slide 27.

A bar 90 is screwed on the flap 69 by means of screws 89 (Fig. 4). This bar 90 is bent upwards at its front part and there provides an oblique surface 91, a horizontal surface 92 and another oblique surface 93. These control surfaces 91, 92, 93 of the rail 90 can cooperate with a roller 94 (Figs. 2 to 4). The roller 94 is mounted to revolve on a supporting member 96 by means of a rivet 95 (Fig. 4). The said member 96 at one end is mounted for adjustment by means of screws 97 on the tabulator rider 99 set on the tabulator bar 10 opposite the column totalizer 98 storing the product and at its opposite end is mounted for adjustment on another tabulator rider 100.

Arrangement of the setting mechanism for the registration wheel 6

A U-shaped member 102 is fastened at the left end section of the slide 27 by means of screws 101 (Figs. 3 and 9) and a ratchet 104 is screwed to said U-shaped member 102 by means of screws 103. The teeth of this ratchet are in mesh with a cog wheel 105, having, e. g. 12 teeth, which is fastened to the upper end of a shaft 106 (Figs. 2, 3 and 9), mounted to revolve in the supporting member 31 previously mentioned which is screwed to the rear supporting bar 2*a* of the machine frame 2 by means of screws 107. At the lower end of shaft 106 (Figs. 2, 3, 8 and 9) a cog wheel 109 with e. g. 20 teeth is rigidly mounted by means of a sleeve 108. Said toothed wheel 109 is in mesh with a ratchet 110 which is screwed on the slanted part of a slide 111 referred to henceforth as "sliding carriage 111." By means of the headed screws 112 (Fig. 8), the heads of which move in guide slots 113 of a rectangular bar 114, the sliding carriage 111 is mounted to slide on the bar 114, in horizontal direction. The bar 114 is fastened to the rear section of the frame 116 containing the multiplying mechanism, by means of screws 115.

A U-shaped setting member 118 (Fig. 9) is also fastened to the sliding carriage 111 by means of a screw 117 (Fig. 8), which by means of bore holes 119 (Fig. 8) drilled in its leg encircles with little play the shaft 7 of the multiplying mechanism 1 (Fig. 3). The registering wheel 6 is mounted to slide but not to revolve on the shaft 7 between the two legs of the setting member 118. Consequently, wheel 6 is forced to participate in the horizontal movement of the sliding carriage 111 meshing consecutively with each of the toothed wheels of the gear systems 3 and 4 (Figs. 2, 3 and 8).

In the rest position of the coupling rod system 18, 27, 106, 111, the registering wheel 6, as may be seen on Fig. 3, is in mesh with the toothed wheel M controlling the multiplication proper, and mounted to the left of the multiplicator train of wheels 4.

The individual toothed wheels of the gear systems 3 and 4 are loosely mounted to turn side by side on a shaft 121 fixed in the frame 116 of the multiplying mechanism 1 by means of their hubs 120 (Fig. 3). Consequently, the front surfaces of said hubs 120 of the adjoining gears will rub against each other so that it might be possible for the adjoining wheels to the left and to the right of one particular wheel in the train of wheels 3 and 4 to be taken along so that certain values are registered unintentionally. In order to avoid such faulty registrations, the following device has been provided.

Device for preventing the frictional turning of wheels adjoining the wheel to be revolved within the train of wheels 3 and 4

A bent supporting member 123 is mounted on the setting member 118 (Figs. 3, 8 and 8*a*) by means of a screw 122 (Fig. 8). A catch pawl 125 by means of its hubs 126 is mounted to swing on a headed screw 124 which is screwed in the forwardly bent part of the supporting member 123. A coil spring 127 is wound around the hub 126 of the catch pawl 125. One arm of said spring 127 is fastened in a bore hole 128 of the supporting member 123, whilst its other arm rests on the catch pawl 125. The coil spring 127 tends to move the catch pawl 125 constantly anticlockwise around the screw 124 (Fig. 8) until in the rest position a bent lug 130 of the pawl 125 comes to lie upon the upper edge 131 of the supporting member 123. The catch pawl 125 (Figs. 8 and 8*a*) is also provided with a bent catch 132 having two catch teeth 133 and 134 which enter into the opposite recesses of those wheels of the wheel system 3 and 4 which adjoin the particular gear in mesh with the registering wheel 6.

The catch pawl 125 is also provided with a forward pointing arm 135, the upper edge 136 of which is in slight contact with a bar 137 (Figs. 3 and 8). Said bar 137 is mounted at the left in a lever 138 (Figs. 3 and 8) and at the right in a lever 139. Both levers 138 and 139 are fastened rigidly on a shaft 142 which is mounted to revolve in the supporting catches 140 and 141 of the frame 116. The lever 138 (Figs. 2, 3 and 8) has a pin 143 and the lever 139 has a pin 144 riveted in. These pins protrude through curved longitudinal slots 145 of the levers 146 and 147 which are mounted on a shaft 148 supported in the frame 116. The shaft 148 and the levers 146 and 147 can be moved clockwise (Fig. 8) by means of suitable means not shown when depressing an operating key R (Fig. 1), whereby the multiplying process, that is calculating of the product, is started. If this is the case, the pinslot connections 145, 143 and 145, 144 as well as the members 137, 138, 139 and 142 are likewise moved clockwise (Figs. 2 and 8) around the pivots 140, 141. Simultaneously the bar 137 acts upon the edge 136 (Fig. 8*a*) of the arm 135 of the catch pawl 125, moving the latter against the coil spring 127 clockwise around the screw 124. Accord-

ingly, the catch teeth 133 and 134 of the catch pawl 125 move out of the opposite recesses of the toothed wheels of the gear systems 3 or 4, just locked by them, so that these toothed wheels are released for revolving. This is necessary since when calculating the product, the individual wheels of the gear systems 3 and 4 are revolved simultaneously more or less by means of a ratchet system B (Figs. 8 and 10) not explained in detail.

When the operating key R, which starts the multiplication, is not depressed, the above-mentioned members are kept in rest position (Fig. 8), so that those toothed wheels of the gear systems 3 or 4 respectively, which are located to the right or left of the toothed wheel just in mesh with the registering wheel 6, are prevented from turning.

Operating Method of the Coupling Device

Entering of the multiplicand

The operating method of the device according to the invention will be explained for better understanding by way of a simple multiplication chosen at random, as follows:

$$3{,}25 \times 1{,}40$$

It should be noted that in the following the place to the left of the comma will be referred to as "units place" and the places to the right of the comma as "tenths"—or "hundredths place."

First the conventional preparations are made for booking on the typewriting-calculating machine and the paper carriage 8 is brought into its extreme right position. Then a preparatory key V (Fig. 1) is depressed, whereby the typewriting-calculating machine is set for multiplication, as described in the Patent ——— (Patent application Ser. Nr. 338,272, filed May 31, 1940).

By depressing the key corresponding to the units-place of the decimal tabulator keyboard 9, the paper carriage 8 is moved towards left in the conventional manner until the units-place of that respective column totalizer 12 is put into operating position, that is, opposite the driving gear A (Fig. 11), in which the multiplicand value "3,25" shall be stored.

During this movement towards left of the paper carriage, the coupling hook 14 in the position of the paper carriage shown in Fig. 10 with its catch 15 engages the hook 17 of the pawl 18 so that the coupling rods 18, 27, 46, (Figs. 4, 5) thereby participate in the further movement of the paper carriage towards left. In this beginning of the movement the pin 49 of the locking pawl 46 slides from the oblique edge 50 of the control member 51. Consequently the locking pawl 46 is turned anticlockwise around its pivot 45 by the spring 47 and then lies with its front edge 46a against the pin 52. Simultaneously the locking pawl 46 in this position comes to lie with its edge 53 against the edge 14a (Fig. 6) of the coupling hook 14. In this way a safe coupling connection between the rider 13 and the coupling rods 18, 27, 46 is established in both directions of movement.

During the leftward movement of the coupling rods 18, 27, 46, the spring 37 (Fig. 3) is contracted. Simultaneously by means of the ratchet 104 (Figs. 3 and 9) of the slide 27 the toothed wheel 105 in mesh with the said ratchet as well as the shaft 106 and the toothed wheel 109 mounted on same are revolved anticlockwise (arrow a). The latter moves the ratchet 110 with which it is in mesh and thereby also the sliding carriage 111 (Fig. 9) towards right (direction of arrow 39) in the opposite direction of the tabulating movement of the paper carriage 8, whilst the headed screws 112 (Fig. 8) screwed into the same slide in the guide slots 113 (Fig. 9) of the angular rail 114.

It will be noted that owing to the different numbers of teeth of the toothed wheels 105 and 109, the distance of movement of the sliding carriage 111 is larger than that of the paper carriage 8.

The setting member 118 with the registering wheel 6 is forced to participate in the movement towards right of the sliding carriage 111. That particular tooth of the registering wheel 6 which happens to face a recess of the single wheels of the gear systems 4 and 3 consequently slides past the recessès of the toothed wheels of the multiplicator gear system 4 and then past the places of a higher denomination located to the left of the units-place of the multiplicand gear 3 and finally at the end of the rightward movement meshes with the units-gear E of the multiplicand gear 3 (Fig. 11). At this moment the tabulating movement towards left of the paper carriage 8 as well as the movement towards left of the coupling rods 18, 27, 46, 104, the movement of the members 105, 106, 109 in the direction of the arrow a and the movement towards right of the members 110, 111, 118 and 6 are finished. Consequently the units-place of the column totalizer 12 and the registering wheel 6 are now in operating position, the latter being opposite the units-place E of the multiplicand gear 3.

The supporting member 123 (Fig. 8a), and therewith the catch pawl 125 also participated in the movement towards right of the setting member 118. At the end of the tabulating-and setting movement of the members 111, 118 and 6, as shown in Fig. 11, the left tooth 133 (Fig. 8a right) of the catch pawl 125 now meshes with the wheel (tens wheel Z) located on the left of the units-place E (Fig. 11) of the gear system 3 and the right tooth 134 of the catch pawl 125 meshes with the gear (tenths wheel ZT) located on the right of the units wheel E of the multiplicand gear 3. Consequently, the adjoining wheels to the right as well as to the left of the units wheel E of the gear system 3 are barred from any revolving movement and therefore cannot participate in any turning of the units wheel E.

The tabulating- and setting movement of the paper carriage 8 and the registering wheel 6 finished, the calculating key marked "3" of the calculating keyboard 5, (fig. 1) is depressed in order to register the "3" of the multiplicand "3,25". Consequently the conventional column totalizer mechanism of the machine is started, as described in detail in the Patent ——— (Patent application Ser. Nr. 338,272, filed May 31, 1940) and the coupling 150, 151 (fig. 3) is locked. Then the known column totalizer shaft 152 is turned automatically by three units in the direction of the arrow 153. The shaft 7 (fig. 8) and the registering wheel 6 also participate in this movement by means of the locked coupling 150, 151. Since the latter is in mesh with the units wheel E of the gear system 3, as mentioned above, the units wheel E is likewise positively turned by three units in the direction of arrow 153a. This driving movement is now transferred by the units wheel E of the gear system 3 upon the opposite ratchet of the ratchet gear system B of the multiplying mechanism.

Simultaneously with the registration of the

"3" of the multiplicand value "3,25" into the multiplying mechanism, a "3" is also registered additively in the units place of the column totalizer 12 and the type-lever of the figure "3" is positively made to write upon the booking sheet directed around the platen of the paper carriage 8. The falling-back of the type-lever then releases the carriage switching device so that the paper carriage 8 further supported by a carriage feeding mechanism, moves one shifting step to the left.

Owing to the coupling connection 14, 15, 17 (fig. 11), 18, 46, the coupling rods 27, 104 (fig. 3) are also positively moved towards left by a further shifting step against the spring 37. Thereby the shaft 106 by means of the gears 104, 105 is moved further in the direction of arrow *a* and consequently the sliding carriage 111 by means of the gears 109, 110, and also the setting member 118, the registering wheel 6 as well as the catch pawl 125 by means of the member 123 (fig. 8*a*) are moved towards right by one step (direction of arrow 39). The registering wheel 6 thereby comes into mesh with the tenths wheel Z*t* of the train of wheels 3 (fig. 12).

Shortly before completion of this movement of the catch rods 18, 27, 46 by one step towards left, the edge 62 (fig. 4) of the pawl 18, contacts with the pin 63 of the supporting member 66. Consequently, during the subsequent slight leftward movement of the members 18, 27, 46 until the completion of this movement by one step, the pawl 18 and the pawl 46 are slightly moved clockwise around the pivot screw 25 against the spring 54, the coupling rods 18, 27, 46 assuming the position with respect to the member 14 as shown in fig. 12. The distance covered by the pawl 18 in this case will only be a short one, so that the coupling connection 15, 17 for the time being remains intact.

The shifting step of the paper carriage towards left just described caused the comma position of the column totalizer 12 to be moved into operative position. As mentioned previously, the tabulator-and comma rider 11 (figs. 4 and 12) is located opposite this calculating place on the tabulator rail 10 and its catch 154 at this moment operates a distance skipping device, the shifting step to the left of the paper carriage 8 thus being succeeded by a further shifting step towards left by automatic and positive action. The coupling connection 15, 17, will, of course, impart to the coupling rods a still further movement towards left. At the beginning of the latter, the oblique edge 62 of the pawl 18 slides further along the pin 63 of the supporting member 66. Consequently also pawl 18 and pawl 46 are moved further around the pivot screw 25 against the spring 57. In doing so, the catch 17 of the pawl 18 slides off the edge 15 of the coupling hook 14, so that the coupling connection 15, 17 for the coupling rods is interrupted. At this moment the spring 37, which has previously been contracted, takes effect and by its tension causes the coupling rods 27, 18, 46 to be moved towards right in the direction of the arrow 39.

Meanwhile the shifting step towards left (comma skipping) of the paper carriage 8 which, as previously mentioned, had been released by the catch 154 of the rider 11 takes place, so that now the paper carriage and the coupling rods move in the opposite direction. The movement of the coupling rods 18, 27, 46 is stopped, however, by the edge 16 of the coupling hook 14, which has been released by the width of a shifting step, the hook 17 clinging to the edge 16 (fig. 13). It follows that the coupling rods 18, 27, 46 and the driven members 104, 106, 110, 111, 6 (fig. 3) annul for themselves the comma skipping of the paper carriage 8, so that the registering wheel 6 is moved by only one switching step, whilst the paper carriage 8 and its column totalizers jump by two switching steps from the units-place of the column totalizer 12 beyond the comma place into the tenths place. This is done for the reason that, as known, no comma- or vacant places have been provided in the multiplying mechanism in order to save space.

These operations completed, the tenths place of the column totalizer 12 as well as the tenths place ZT of the multiplicand gear system 3 are in their operating positions (fig. 13).

Now the calculating key "2" of the calculating keyboard 5 (fig. 1) is depressed in order to enter the "2" of the value "3,25", whereupon the gear of the tenths place ZT (fig. 13) of the gear system 3 and the opposite ratchet of the ratchet system B as well as the tenths place of the column totalizer 12 are set by two units and the type lever carrying the "2" is made to print on the sheet before the platen. The subsequent falling-back movement of the type lever releases another shifting step of the carriage towards left. Owing to the coupling connection 16, 17 (fig. 13), the coupling rods 18, 27, 46 participate in this leftward movement. Simultaneously the horizontal rear edge 62*a* (fig. 13) of the pawl 18 slides along the pin 63, but this movement is not imparted to the pawl 18 itself.

Owing to the continued leftward movement of the coupling rods 18, 27, 46, the sliding carriage 111, by means of the ratchet gear 104 (Figs. 3 and 9), 105, 106, 109, 110, and the registering wheel 6 as well as the catch members 123, 125, by means of the member 118, are moved towards right (direction of arrow 39) by one further shifting step. Consequently on completion of this shifting step the hundredths place of the column totalizer 12 is in operating position and the registering wheel 6 is in mesh with the hundredths gear H*t* of the multiplicand train of wheels 3. In this position of the coupling rods 18, 27, 46 and so on, the strip-off edge 62 of the pawl 18 engages from the right with the second strip-off pin 64 of the supporting member 66.

Now the key of the calculating keyboard 5 (Fig. 1) corresponding to the value "5" is depressed in order to enter the "5" of the multiplicand "3,25", whereby said value is entered into the hundredths place H*t* (Fig. 3) of the multiplicand gear set 3 and the gear ratchet system B, as well as into the hundredths place of the column totalizer 12, and the type lever corresponding to "5" is made to strike.

The falling-back movement of the type lever releases another shifting step of the paper carriage again and simultaneously the coupling rods 18, 27, 46 are likewise carried along towards left by means of the coupling connection 16, 17 (Figs. 3, 4 and 13). Consequently the oblique edge 62 of the pawl 18 slides past the pin 64 of the supporting member 66 whereby pawl 18 and pawl 46 are swung further clockwise (Fig. 3) around the pivot screw 25 against the spring 57 (Fig. 4). Thereby the catch 17 of the pawl 18 clears edge 16 of coupling hook 14, so that the coupling rod system is set free. Through the action of the contracted spring 37 (Fig. 3) the coupling rods 18, 27, 46 at this moment are jerked towards right (direction of arrow 39) into their initial

position in accordance with Figs. 3 and 4, the right end 40 of the slide 27 striking against the rubber stop 41 to reduce the noise. At the beginning of the movement towards right of the rods 18, 27, 46, the rear edge 62a of the catch 62 of the pawl 10 slides off the pin 64, whereupon pawl 18 and pawl 46 are moved anticlockwise around the pivot screw 25 by action of spring 57. The movement of said pawl 18 is halted in the rest position by the edge 60 striking against the pin 61 and the movement of the said pawl 46 is halted by the edge 46a striking against the pin 52. The pawl 46 is again swung out clockwise against the spring 47 around the rivet pin 45 shortly before reaching the right end-position of the rod system 18, 27, 46 by action of pin 49 sliding along the inclined 50 of the control member 51 (Fig. 5). Consequently the pawl 46 with its control or locking edge 53 is located outside of the path of movement of the coupling hook 22 which is positioned on the bar 10 in the plane of the column totalizer 19 storing the multiplicator, whilst the pawl 18 with its catch 17 extends into the pathway of the catch 23 of the coupling hook 22.

During the return movement of the coupling rod system 18, 27, 46 into rest position, simultaneously the sliding carriage 111 by means of the ratchet gears 104, 105, 106, 109, 110 and the registering wheel 6, and the catch member 123, 125 by means of the setting member 118, are returned into the rest position towards left, according to Fig. 3. In this position the registering wheel 6 is in mesh with the wheel M pertaining neither to the gear set 3 nor to the gear set 4.

Entering of the multiplicator

After the multiplicand "3,25" has been registered in the multiplying mechanism of the booking machine in the above-described manner, that is, in the corresponding decimal places of both the gear set 3 and the ratchet system B and stored in the column totalizer 12, the operator of the machine can write any desired text in the space between the column totalizer 12 and the column totalizer 19, by operating the keyboard 5 (Fig. 1). Then he depresses the units-tabulator key of the decimal tabulator keyboard 9, in order to enter the multiplicator "1,40", whereby another tabulating leftward movement of the paper carriage is released. During this movement, the coupling hook 22 (Fig. 14) of the tabulator rider 20 having been set on the tabulator rail 10 opposite the column totalizer 19 storing the multiplicator value, with its catch 23 engages the hook 17 of the pawl 18 and carriers the coupling rod system 18, 27, 46 along towards the left against the spring 37. The pawl 46 with its pin 49 now leaves the control member 50 and—moved anticlockwise around the pivot against the spring 47—comes to lie with its edge 53 against the surface 22a, of coupling member 22, thereby ensuring the driving connection 23, 17 for entering (Fig. 14). It will be noted that the driving connection 23, 17 for entering the multiplicator is established at a later moment than the driving connection 15, 17 (Fig. 10) for entering the multiplicand in the tabulating motion, the delay being defined by the distance marked a (Fig. 10), since the coupling hook 22 is secured directly on the tabulator and comma rider 20 for the column totalizer 19. The additional shifting through distance a was necessary, since the registering wheel had to cover the additional distance "C" corresponding to the width of the multiplicator value.

Owing to this leftward sliding movement of the coupling rod system 18, 27, 46 (Fig. 14), the carriage 111, by means of the gear system 104 (Figs. 3 and 9), 105, 106, 109, 110, and the registering wheel 6 as well as the locking members 123, 125, by means of member 118, are simultaneously moved towards right in such a way that the registering wheel 6 meshes with the units wheel e of the multiplicator gear set 4 (Fig. 14). At this moment the tabulating movement of the paper carriage 8 is completed and simultaneously the column totalizer 19 with its units place has been moved into its operating position.

Whilst the units place is moving into its operating position, the roller 94 (Figs. 2 to 4 and 14) of the supporting member 96, which moved along with the paper carriage 8, simultaneously acts upon the oblique surface 91 of rail 90 of flap 69 and consequently moves the latter as well as the members 81 and 75 against action of spring 77 and in the opposite direction of the arrow 79 around the bearing brackets 72 and 73. Consequently the pins 67 and 68 of the flap 69 are moved into the pathway of the surface 62 of the pawl 18.

The tabulating process completed, the key marked "1" of the calculating keyboard 5 is depressed in order to enter the "1" of the multiplicator "1,40." Thus the "1" by means of the registering members 152 (Fig. 3), 151, 150, 7 and the registering wheel 6 are entered into the units-place e (Fig. 14) of the gear set 4 and by means of the corresponding ratchet of the ratchet system B are entered into the respective place of a multiplying mechanism C not explained in detail which is arranged beside the product mechanism P after the former at this moment had been brought to mesh with the ratchet system 3. On the other hand, the value "1" is entered into the units-place of the column totalizer 19 and by means of the corresponding type lever has been typed upon the sheet on the platen. The falling-back of the type lever then again releases a shifting step of the paper carriage 8 and, in dependence of the coupling connection 23, 17, also a leftward switching step of the coupling rod system 18, 27, 46. Simultaneously, the registering wheel 6 is moved by one shifting step towards right (Fig. 15) by means of the gears 104, 105, 106, 109, 110, 111, 118, so that the said wheel 6 is brought into mesh position towards the tenths gear Zt of the multiplicator gear set 4.

During this leftward shifting step of the coupling rod system 18, 27, 46, the oblique edge 62 of the pawl 18 comes into sliding contact with the pin 67 of the flap 69, whereby the pawls 18 and 46 against action of spring 57 are moved slightly clockwise around the pivot screw 25. For the present, however, the coupling connection 23, 17, still remains intact.

The paper carriage shifting step released by the falling-back of the type lever also caused the comma place of the column totalizer 19 to move into operating position. Consequently the distance-skipping device of the machine thereby placed into operative position in dependence of the catch 20a of the tabulator-and comma rider 20, so that a further leftward shifting step of both the paper carriage 8 and the coupling rod systems 18, 27, 46 is positively effected. During this shifting step the oblique edge 62 of the pawl 18 slides off the pin 67 of the flap 69, whereby the pawls 18 and 46 are moved clockwise around the pivot screw 25 against the spring 57 and con-

sequently the catch 17 of the pawl 18 clears the catch 23 of the coupling hook 22 and thereupon connects with the catch 24 (Fig. 16) which is recessed by the shifting step distance from the catch 23. Consequently the paper carriage 8 is switched by two steps, whilst the registering wheel 6 is moved further by one step only, so that now the tenths place of the column totalizer 19 is moved into operative position and the registering wheel 6 is in mesh with the tenths wheel ZT of the gear set 5.

In order to enter the "4" of the multiplicator value "1,40," the particular key corresponding to the figure "4" on the calculating keyboard 5 (Fig. 13) is depressed, whereby the "4" is entered into the tenths place Zt (Fig. 16) of the multiplicator gears 4 which is driven as explained above. Simultaneously the "4" by means of the opposite ratchet of the ratchet system B is also entered into the respective place of the multiplying mechanism C as well as into the tenths place of the column totalizer 19 and printed on the sheet held in the paper carriage. The subsequent shifting step of the paper carriage 8 and of the coupling rod system (18, 27, 46) then moves the hundredths place Ht of the gear system 4 as well as the hundredths place of the column totalizer 19 into operative position. In this position the particular key of the calculating keyboard 5 corresponding to "0" is depressed, whereby no value is entered but only the type lever is moved causing a further leftward shifting step of the paper carriage 8 as well as of the coupling rod system 18, 27, 46. Simultaneously the slanting edge 62 of the pawl 18 slides along the second pin 68 of the flap 69, whereby the pawls 18 and 46 are moved further clockwise around the screw 25 against the spring 57 and consequently the catch 17 of the pawl 18 leaves the edge 24 of the coupling hook 22. The movement towards left of the coupling rod system having contracted the spring 37, the coupling rods 18, 27, 46 now tend to move towards right again whilst the registering wheel 6 on the shaft 7 slides towards left again by means of the gears 104, 105, 106, 109, 110, 111, 118 (Figs. 3 and 9).

As soon as the catch 17 of the pawl 18 has been moved out of the path of the coupling hook 22, the pawls 18 and 46 by the spring 57 are swung back into rest position, according to Figs. 3 to 5.

The movement of the coupling rod system 18, 27, 46 towards right (direction of arrow 39) and the movement of the sliding carriage 111 and the registering wheel 6 towards left is limited in that moment in which the registering wheel 6 is in mesh with the respective gear of the gear system 4 corresponding to the tens position z (Fig. 17). This limitation takes place as follows:

Setting of the coupling rod system during total-taking of the product

When tabulating the column totalizer 19 into operative position—as already explained above—the flap 69 and the roller 71 as well as its lever 75 were moved in dependence of the roller 94 (Fig. 4) of the supporting member 96 against action of spring 77 in the opposite direction of arrow 79. This swing movement was shared by the locking lever 82 by means of the spring connection 76, 81, 83 (Fig. 5). Said locking lever 82 thereby comes to lie with its catch 86 upon the surface of the supporting bridge 28 (Fig. 17).

As soon as, after setting the "0" of the multiplicator value (1,40) the shifting step of the paper carriage has been effected and, in dependence of the same, the coupling rod system 18, 27, 46 has been unhooked from the coupling connection 24, 17 and the latter is moved towards right in dependence of the spring 37, the right side-edge 87 of the catch 88 of the slide 27 now contacts with the left side surface of the locking catch 86 of the locking lever 82 in order to check this movement. In this position, as illustrated in Fig. 17, the registering wheel 6 is now in mesh with the tens gear Z of the gear system 4, the reason for this position will be hereinafter explained:

The shifting step of the paper carriage following the typing of the "0" of the multiplicator "1,40" moves the column totalizer 19 into operative position with respect to its right control position (Platine). In this position a comma rider is suitably placed on the tabulator bar 10, which at this moment by means of its nose operates the distance skipping device of the machine, so that the paper carriage 8 is shifted by one further step. Consequently, after registering the hundredths place of the multiplicator value, the paper carriage is moved automatically by two shifting steps towards left, whereby the column totalizer 98, which later on receives the product, moves into operating position with its highest calculating place (Fig. 17). The coupling rod system is not changed thereby in any way since at this moment no coupling connection is established any more.

Now the result key R (Fig. 1) of the booking machine is depressed, whereby the product of the two factors, 3,25×1,40, that is "4,5500" is automatically calculated in the product mechanism P (Fig. 17) of the multiplying mechanism which does not belong to the invention and is therefore not shown. Simultaneously the multiplying mechanism automatically starts operation of the total taking mechanism of the booking machine, not shown. The total-taking from the product mechanism in the present case is effected first by means of the tens place Z (Fig. 7) of the gear set 40 by means of the ratchets D of the ratchet system B located within their reach. Consequently the four highest denominations of the product register P remain unnoticed during the product total-taking, which is due to the fact that the capacity of the column totalizer was selected for values having only nine places. In dependence of the efficiency of the total-taking mechanism, the stepwise shifting of the product mechanism P towards left is controlled simultaneously. In this way all denominations of the product mechanism P corresponding to the units place and places of a higher magnitude are subsequently shifted past the ratchet D (Fig. 17) and also past the tens place of the gear system 4, in order to be set on "zero" by the total-taking process. Those denominations of the product mechanism which correspond to the tens place and the places of a higher order such as hundreds, thousands, ten thousands position and so forth, have in case of the present product "4,5600" already been turned to zero. Consequently, by means of a suitable device, not shown, for preventing the registration of zeros before integers, the printing of zeros on the sheet is made impossible. Besides the shifting by steps of the product mechanism, the paper carriage 8 is also moved towards left in shifting steps until the units place of the column totalizer 98 is placed in calculating position. It may be noted that during the previously mentioned shifting

steps of the paper carriage 8 the roller 94 (Fig. 4) of the supporting member 96 is still rolling on the upper edge 92 of the rail 90 of the flap 69 and consequently the latter remains in the swung-out position (Fig. 17), so that during the shifting of the paper carriage 8 the registering wheel 6 remains in mesh with the tens place of the gear set 4.

Owing to the above mentioned shifting steps of the paper carriage 8 and the product register P towards left, the particular place of the product register P embodying the "4" of the product "4,5500" was also moved into a position opposite the ratchet D, that is, the tens place Z of the gear set 4. Now, through the total-taking process, by means of the ratchet D and the tens place z of the gear set 4, the value "4" is entered from the said place of the product mechanism into the units place of the column totalizer 98. Simultaneously by positively striking the type lever of the figure "4", the same is printed upon the sheet on the platen. Duriing the falling back of the type lever a shifting step of the paper carriage is started, whereby the comma position of the column totalizer 98 is moved into its operative position. Owing to the fact that during the leftward shifting step of the paper carriage 8 also the product mechanism P is positively shifted leftward through one decimal place by the total-taking mechanism, it will be found that at the completion of said shifting steps the column totalizer 98 with its comma place is in operative position and the product mechanism P—not having a common position—with its place embodying the "5" of the tenths place of the product "4,5500" is in total-taking position, that is, opposite the ratchet D of the tens place z of the gear set 4.

In the operative position of the comma place of the column totalizer 98 the comma rider 99 is mounted on the bar 10 and with its catch 99*a* during the total-taking, brings a distance skipping mechanism into operation for an additional shifting step of the paper carriage 8. The shifting of the additional shifting step of the paper carriage is carried out in dependence of another revolution of the drive shaft and simultaneously shifts the product mechanism by a further shifting step. Consequently the place of the product mechanism P embodying the "5" of the hundredths place of the product "4,5500" is automatically into total-taking position, that is, opposite the ratchet D of the tens place z of the gear set 4, without the "5" of the tenths place of the product "4,5500" having previously been set on "0" by total-taking. Consequently, the tenths place after the comma of a product value would be skipped during total-taking. To avoid such faulty calculation the following device has been installed:

Comma skipping during product total-taking

The automatic engagement of the total-taking mechanism of the booking machine after calculating the product is effected by positive moving of the total-taking key lever 155 (Fig. 2) clockwise around its shaft 156. Simultaneously the arm 157 of the key lever 155 moves backward a bar 158 jointed to the same. A roller 159 of this bar 158 consequently bears upon a slanted surface 160 of a slide 161 which is mounted to slide along the rear wall of the machine frame by means of pin and slot connections and moves said slide 161 upwards against the spring 162. A supporting member 164 is mounted to slide on the upper part of the slide 161 by means of a screw 163 (Fig. 4) and acted upon by a pressure spring 167 which is attached at one end to the pin of the screw 163 and at the other end to a pin 166 riveted into said supporting member and protruding through a longitudinal guiding slot 165 of the slide 161. The supporting member 164 is also guided by a recess 168 of the supporting bridge 28.

The supporting member 164 participates in the upward movement of the slide 161 by means of the flexible connection 163, 167, 166 and thereby is moved into the path of a catch 169 of the slide 27 of the coupling rod system 18, 27, 46, which at this moment assumes the position shown in Fig. 17, the catch 169 being spaced from the left of the supporting member 164 by one shifting step.

As soon as on product total-taking the "4" of the product "4,5500" has been printed, the shifting step of the paper carriage has been positively effected and consequently the comma place of the column totalizer 98 has moved into operative position, the roller 94 of the member 96 (Figs. 4, 5 and 18) will also slide down the slant 93 of the rail 90 of the flap 69. Consequently the members 69, 71, 75 and 82 under action of spring 77 are returned to rest position in the direction of the arrow 79 and the edge 80 of the lever 75 strikes against the rear edge 28*a* of the supporting bridge 28. Simultaneously the lock-catch 86 of the locking lever 82 is again moved out of the pathway of the edge 87 of the catch 88 of the slide 27 so that now the coupling rod systems 18, 27, 46 are moved towards right by means of the spring 37. After having traversed a distance corresponding to one shifting step of the paper carriage, the movement of the coupling rod systems 18, 27, 46 towards right is stopped by the right lateral surface of the catch 169 of the slide 27 striking against the left lateral surface of the supporting member 164 (Fig. 18). Simultaneously the registering wheel 6 is moved by one shifting step towards left by means of the gears 104, 105, 106, 109, 110, 111, 118, so that thereafter the same is in mesh with the ratchet F of the ratchet system B corresponding with the hundreds gear *h* of the gear set 4, as shown in Fig. 18.

It follows from the above that on skipping the comma place of the column totalizer 98 during the product total-taking, the paper carriage 8 and the product mechanism P of the multiplying mechanism are moved by two shifting steps, the registering wheel 6, however, is also moved by one shifting step, so that the latter now faces the hundreds place *h* of the gear set 4 and serves to drive the same for the purpose of total-taking from the product mechanism.

As explained above, the "5" of the tenths place of the product "4,5500" after skipping the comma place faces the hundreds place *h* of the gear system 4, so that for the present the tenth place of the product "4,5500" is set to zero by total-taking. Thereupon the type print of the "5" starts a further shifting step of the paper carriage 8 as well as of the product mechanism P, so that thereafter the "5" of the hundredths place of the product "4,5500" is moved into total-taking pick-up position, i. e., facing the hundreds place *h* of the ratchet F of the ratchet system B co-ordinated with the gear system 4, and is reset.

Subsequently, the thousandths- and ten thousandths places of the product "4,5500" are cleared by total-taking. Since, however, these places in the present product "4,5500" already contain

"zeros", no clearing takes place by product total-taking. By means of a convenient cancelling mechanism, not shown and described, the values of the third and fourth places to the right of the comma are prevented from being printed. Neither can these values be included in the calculation of the comma totalizer **98**, since this column totalizer commands only two calculating places to the right of the comma.

The product total-taking completed, the total-taking mechanism is also arrested automatically in a suitable manner since the key lever **155** (Fig. 2) is returned anti-clockwise into its rest position. Consequently the bar **158** is again moved towards front, the roller **159** releasing the slant **16** of the slide **161**. The slide **161** and its supporting member **164** are now moved downwards again by the spring **162** whilst the member **164** is again placed out of reach of the catch **169** of the slide **27**. Consequently the coupling rod system **18, 27, 46** is released and at this moment is jerked back into rest position in the direction of arrow **39** by means of the spring **37**, the catch **40** of the slide **27** striking against the rubber stop **41** (Fig. 4). The registering wheel **6** is also moved towards left into rest position (Figs. 3 and 5) by means of the gears **104, 105, 106, 109, 110, 111, 118**. Simultaneously the products register P and the multiplicator register C are suitably moved towards right into rest position, according to Fig. 10.

As soon as the entries upon the line of the sheet have been completed, the paper carriage **8** is again moved to its outer right position by depressing the carriage sliding key **170** (Fig. 1). During this movement of the paper carriage towards right, the roller **94** (Fig. 4) of the supporting member **96** slides along the surface **93, 92** of the rail **90** of the flap **69**, whereby the latter as well as the members **71, 75** and **82** are swung out in the opposite direction of the arrow **79** against action of spring **77**. Since, however, after a short while the catch lever **82** by means of its catch **86** strikes against the upper side of the catch **88** of slide **27** of coupling rod system **18, 27, 46**, the catch lever **82** does not participate any more in the further movement of the members **69, 71, 75**, but only the spring **81** is contracted.

During the subsequent movement towards right of the paper carriage the roller **94** again slides down the slant **91**, whereby the members **90, 69, 71, 75, 82** are returned into rest position by the spring **77**.

On further sliding movement of the carriage, the coupling hook **22** by means of its slanted edge **22***a* (Fig. 7) also bears upon the slant **17***a* of the hook **17** of the pawl **18**. The latter recedes clockwise against action of spring **57** and, after releasing the coupling hook **22**, returns again into its normal position. The same process is repeated as soon as during the sliding movement of the carriage the coupling hook **14** gets in contact with the catch **17** of the pawl **18**. The locking pawl **46** is not touched thereby since in the rest position of the coupling rod system **18, 27, 46** it is kept outside of the path of movement of the coupling hooks **14** and **22** by the controls **49, 50**.

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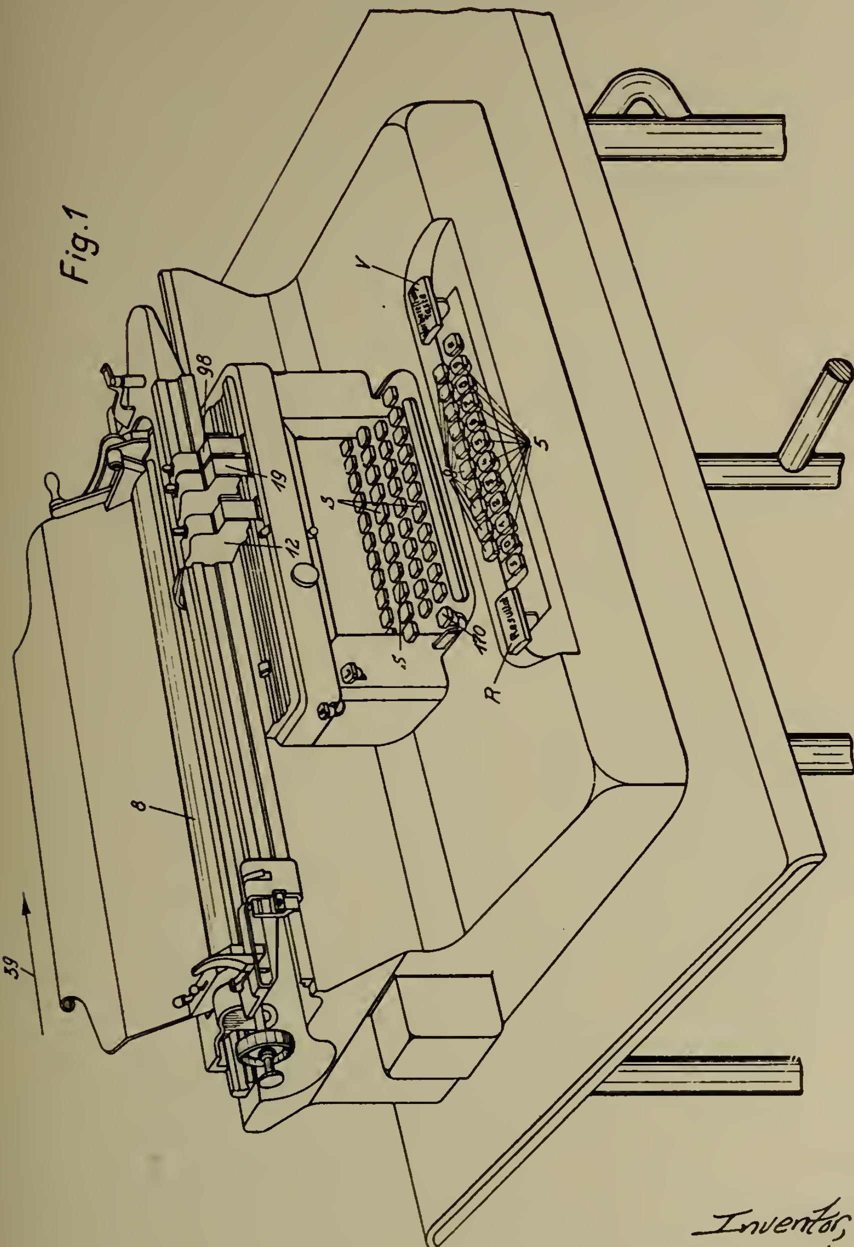
TYPEWRITING-CALCULATING
MACHINES EQUIPPED WITH
TOTAL-TAKING MECHANISM
Filed April 30, 1941

Serial No.
391,202

10 Sheets–Sheet 1

Fig. 1



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10 Sheets-Sheet 2

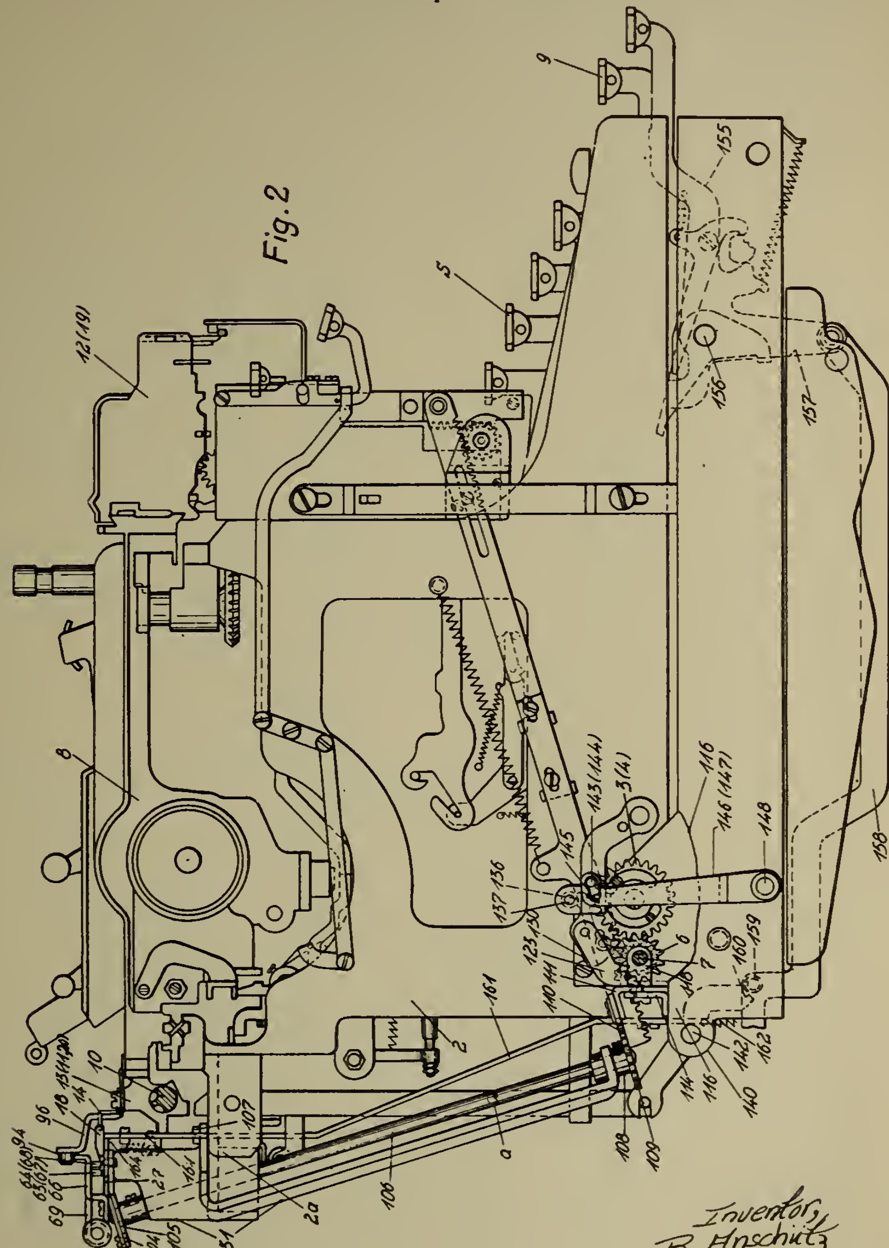

Fig. 2

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Serial No. 391,202

10 Sheets-Sheet 3

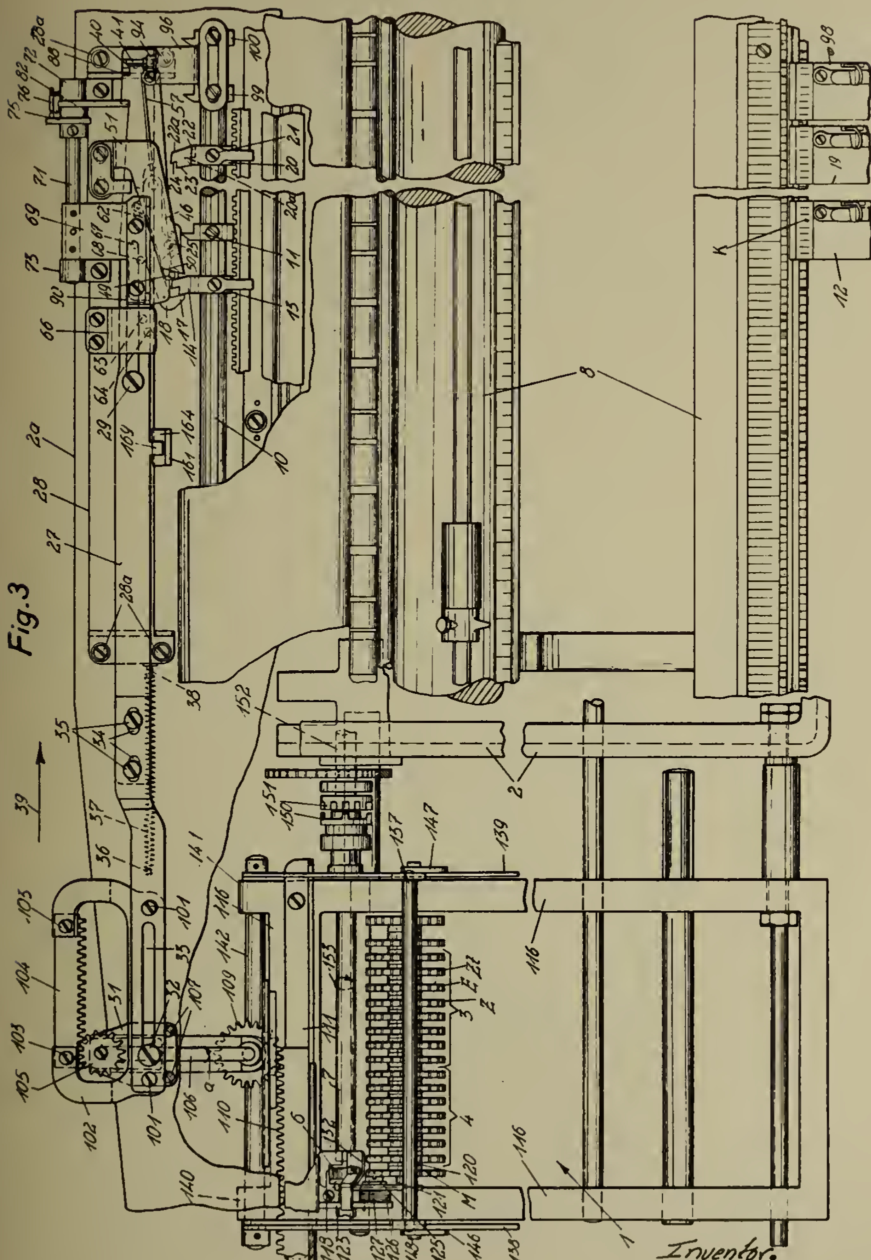

Fig. 3

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10 Sheets-Sheet 4

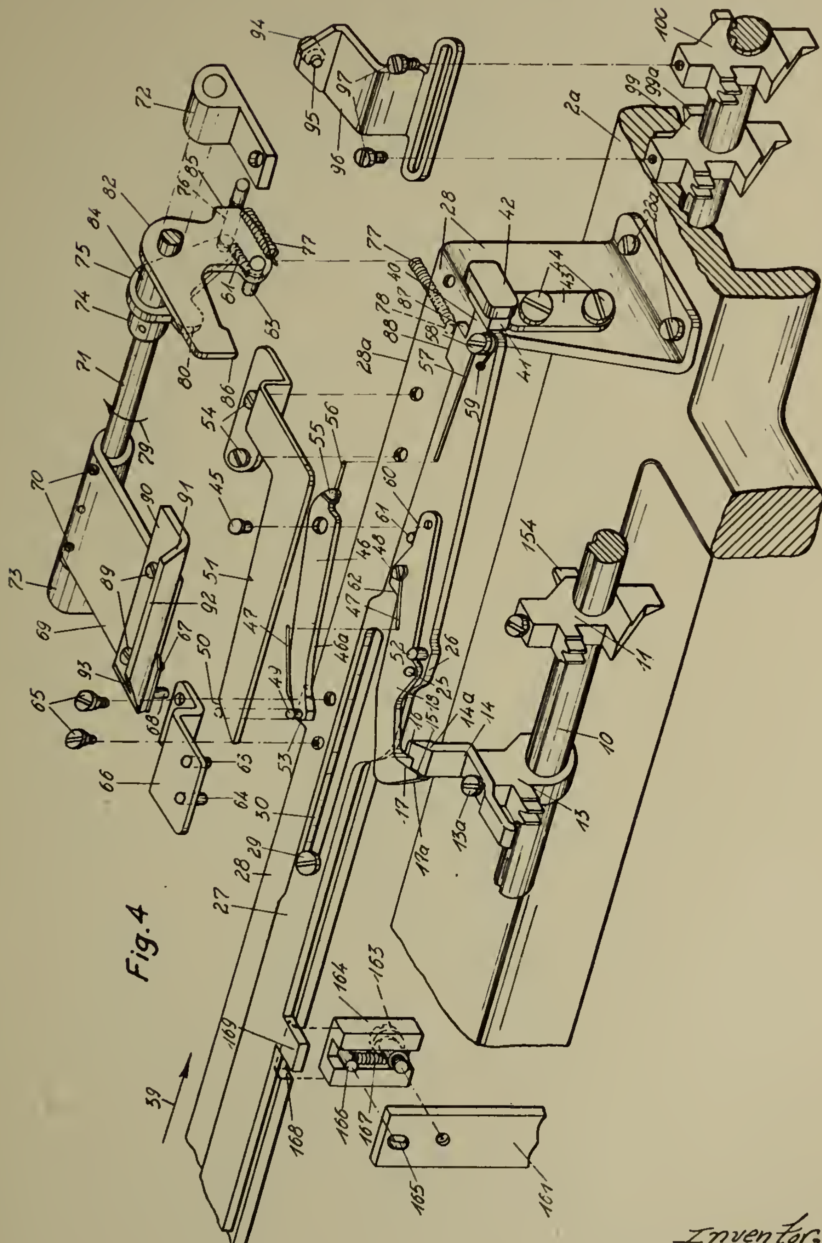

Fig. 4

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391,202
10 Sheets-Sheet 5

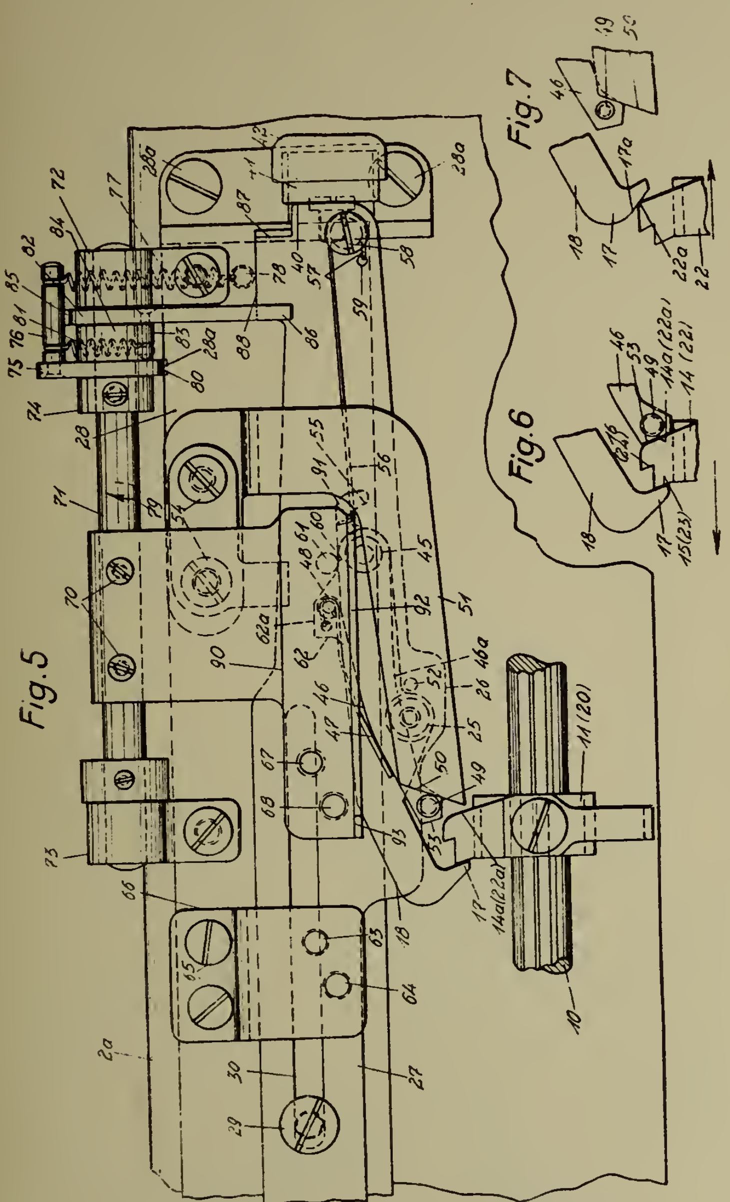

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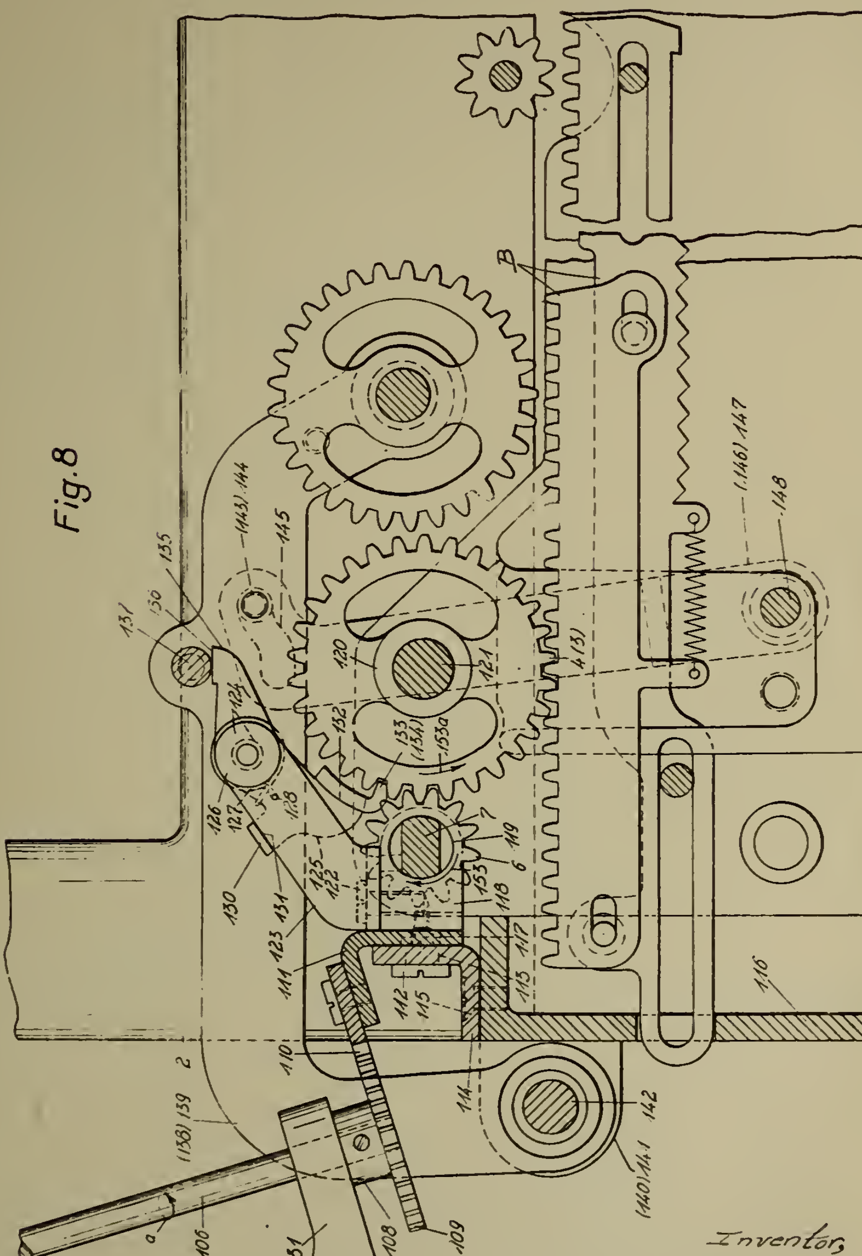
Fig. 8



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10 Sheets-Sheet 7

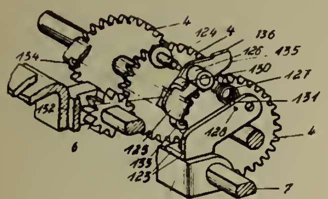

Fig. 8a

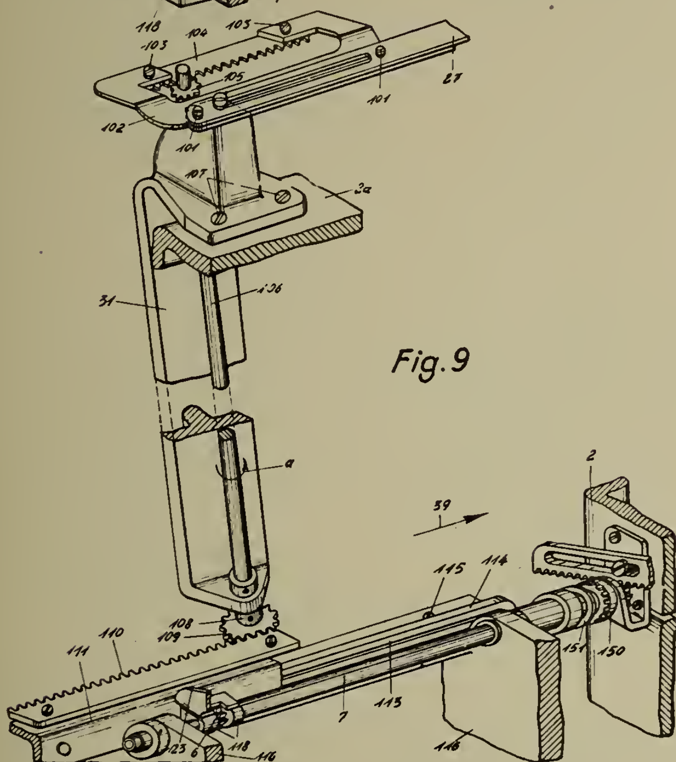

Fig. 9

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10 Sheets-Sheet 8

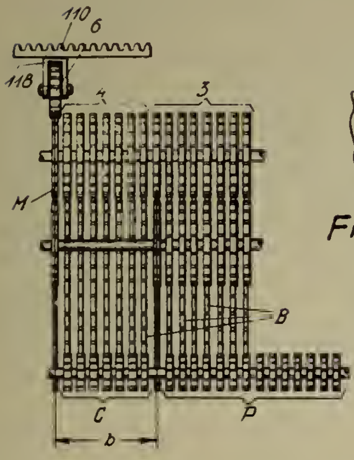
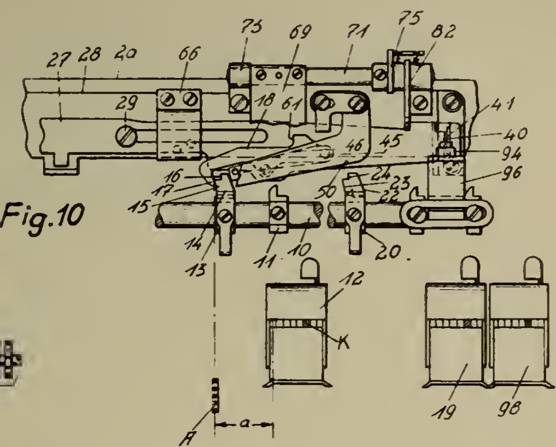


Fig.10



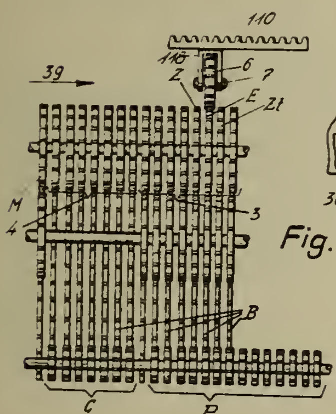
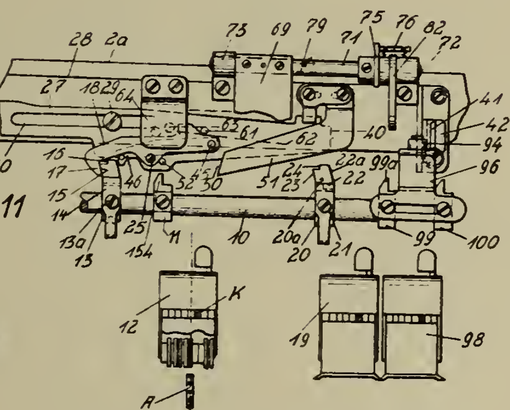


Fig.11



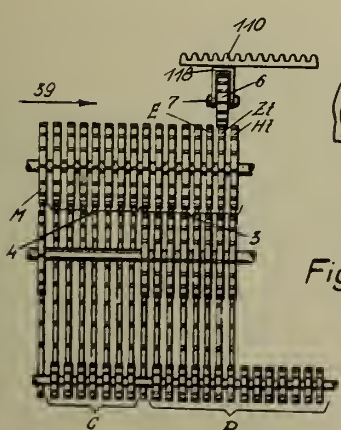
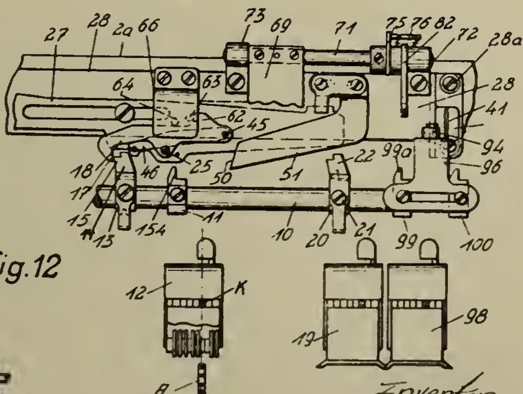


Fig.12



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BOOKING MACHINES, ESPECIALLY TYPEWRITING-CALCULATING MACHINES EQUIPPED WITH TOTAL-TAKING MECHANISM

Filed April 30, 1941

Serial No. 391,202

10 Sheets-Sheet 9

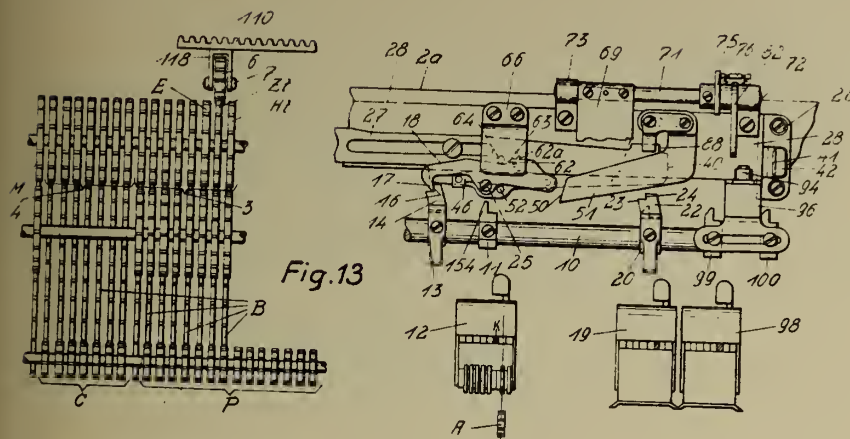

Fig.13

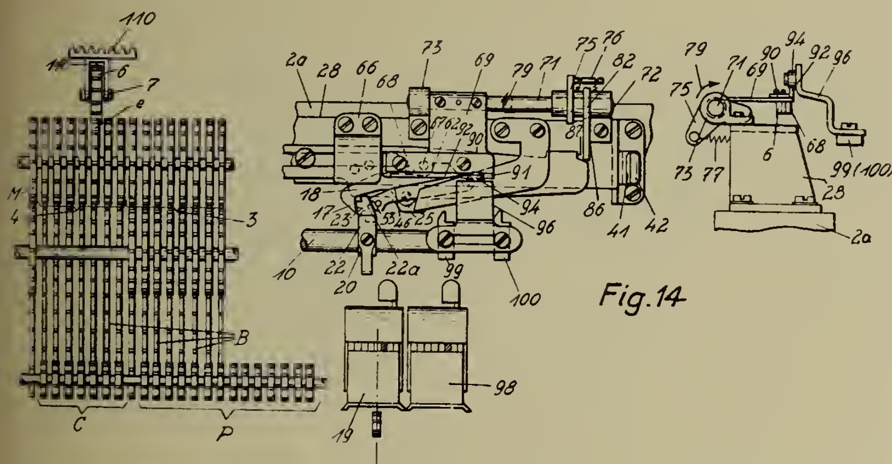

Fig.14

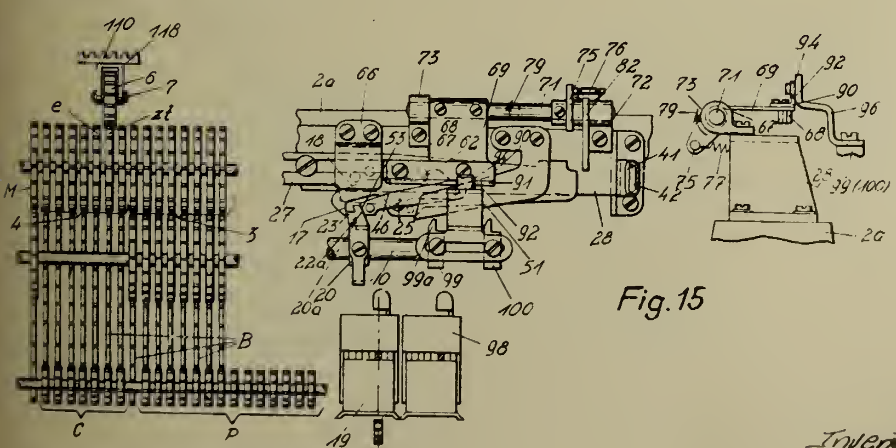

Fig.15

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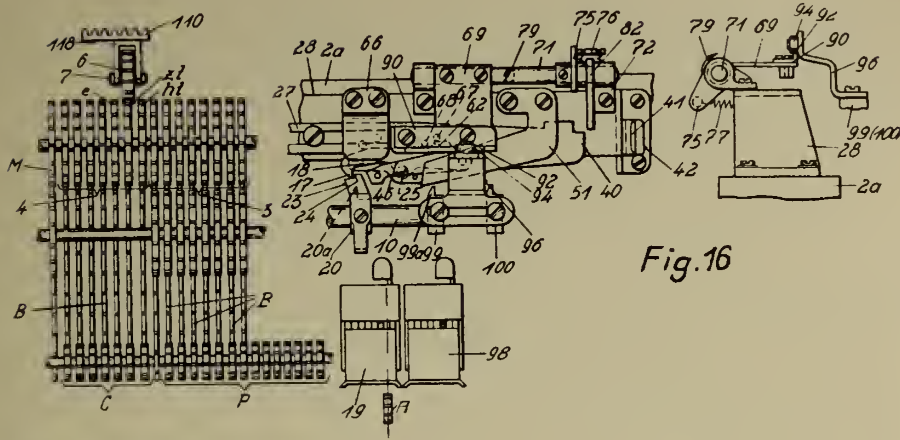

Fig. 16

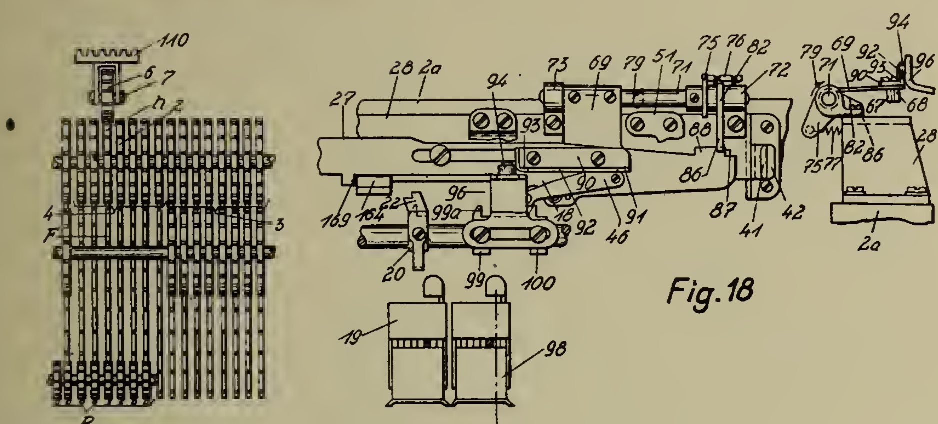

Fig. 18

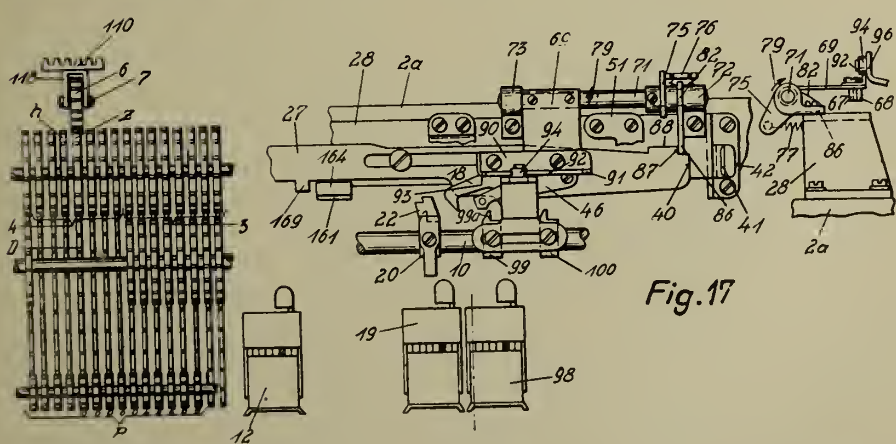

Fig. 17

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ALIEN PROPERTY CUSTODIAN

VEHICLE BODY

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Application filed May 5, 1941

This invention relates to a vehicle body, such as an automobile body composed of a plurality of parts, such as the roof, sides, rear, and windshield frame, which consists of artificial materials of great strength and elasticity. Preferably, these materials consist of laminated pressings saturated with a synthetic resin. The pressings are usually made of fibrous materials, namely, paper or cardboard bands or textile bands which are saturated with synthetic resin. This invention refers also to a method of making such an automobile body.

The various automobile body parts are pressed into the desired shape out of a large number of layers of saturated materials in suitable forms, mostly steel molds. The finished parts are usually interconnected by glue, bolts or rivets. For this purpose, the edges of these body parts are provided with connecting flanges adapted to receive the bolts or other connecting means and extending at right angles to the surfaces of the body parts. These flanges are pressed together with other portions of the body parts, and in order that the flanges and the portions adjacent thereto should be sufficiently strong and resistant to bending forces, strengthening ribs are provided in zones of greater stress.

In comparison with all other portions of an automobile body part, which are fairly thin, the connecting flanges and the strengthening ribs present a considerable accumulation of material. The hardening time of the pressing in the mold and, consequently, the output of the latter, are determined by the thickest cross-section of the pressing, so that the flanges and ribs make it necessary to increase the time of pressing automobile body parts to a considerable extent.

Furthermore, the connecting flanges make the pressing process much more difficult than it would be otherwise; often the paper or textile bands cannot extend through the entire body part, so that additional tablets of the material must be compressed at places where the connecting flanges are to be formed. In many instances the flanges and ribs harden in a different manner than a thin wall hardens. All this results in that a body part is produced the strength of which is different at different places.

A further drawback of these connecting means consists in that in case of an accident, when the interconnected portions are subjected to an excessive strain, the flanges can easily tear off, since their cross-sectional areas are weakened by holes provided therein for screws and bolts, so that their resistance against bending forces is quite weak. The flanges can be easily strained above the elasticity limit of the material, and then breakage results.

An object of the present invention is to eliminate the drawbacks of prior art constructions and to provide an automobile body various parts of which, consisting of laminated materials saturated with artificial resin, can be easily and quickly pressed and assembled without the use of thick and heavy flanges.

Another object is the provision of novel, simple and effectively operating connecting means for the various parts of an automobile body.

A further object is to provide connecting means for automobile body parts which will make it possible to manufacture comparatively thin body parts of great strength, said parts consisting of layers of continuously extending impregnated bands.

A still further object is the provision of comparatively thin automobile body parts of great elasticity and strength and small weight, which can be easily and conveniently connected with each other, and when so connected, will constitute an automobile body of great strength and resistance against shocks.

An additional object of the present invention is to facilitate the manufacture of pressed automobile body parts and to make this manufacture economical by eliminating inconveniently thick cross-sectional areas of such body parts.

A further object is to simplify and expedite to the greatest possible extent the assembly of parts constituting an automobile body.

Yet another object of the present invention is to provide automobile body parts all the portions of which are alike in texture and wall thickness and have the same arrangement of layers, so that each body part is of comparatively uniform strength throughout the various portions thereof, and so that all portions or zones of a body part may be subjected to a uniform strain.

Other objects of the present invention will become apparent in the course of the following specification.

In realizing the objects of the present invention, it was found advisable to strengthen from the inside the zones of greatest stress of the body parts, consisting of pressed synthetic resin saturated material, through the provision of profiled metal bars interconnected to form a continuous supporting structure. This structure may be provided with clamping devices which are preferably bent over the edges of the various

body parts and which unite them into an assembled body. Consequently, in accordance with an embodiment of the present invention, no rivets or bolts are used to interconnect the various body parts, which may be connected directly to the metal bars, thereby making it possible to eliminate the usual thick connecting flanges.

In accordance with a preferred embodiment of the inventive idea, the connecting edges of the automobile body parts are slightly thickened to form beads enclosed by metallic connecting flanges of frame supports, for instance, box-like metal rods, said flanges being bent over the beads. Thus, the edges of the body parts are made only slightly thicker than all the other portions of the body parts.

In accordance with another preferred embodiment of the inventive idea, the metal bars are coated with artificial resin, in order that the properties of the two substances may advantageously supplement each other, particularly as far as firmness is concerned. Since steel and artificial resin have different coefficients of expansion, the steel bar may be covered with an aluminum bar by a rolling process in such manner that the two metals can move relatively to each other during heat expansion. Aluminum has the same coefficient of expansion as artificial resin and serves, therefore, as a carrier for the artificial resin mass which, preferably, is carried by laminated fillers. Obviously, the steel inserts may be eliminated entirely and the frame structure may consist of hard aluminum bars.

The invention will appear more clearly from the following detailed description when taken in connection with the accompanying drawings, showing by way of example, preferred embodiments of the inventive idea.

In the drawings:

Figure 1 is a perspective view of an automobile body constructed in accordance with the principles of the present invention.

Figure 2 is a section along the line 2—2 of Figure 1, on an enlarged scale, and shows the connection of the windshield frame to the roof and front part of the automobile body.

Figure 3 is a section along the line 3—3 of Figure 1 and shows means supporting the side edge of the roof.

Figure 4 is a section along the line 4—4 of Figure 1 and shows the windshield frame support, the door and the side wall of the automobile body.

Figure 5 is a section along the line 5—5 of Figure 1 and illustrates the connection of the side wall to the automobile floor.

Figure 6 is a perspective view of an automobile body of a somewhat different form.

Figure 7 is a section along the line 7—7 of Figure 6.

Figure 8 is a section along the line 8—8 of Figure 6.

Figure 9 is a section along the line 9—9 of Figure 6.

Figure 10 is a section along the line 10—10 of Figure 6.

Figure 11 is a side view of a different automobile body.

Figure 12 is a section along the line 12—12 of Figure 11.

Figure 13 is a section along the line 13—13 of Figure 11.

Figure 14 is a section along the line 14—14 of Figure 11.

Figures 15, 16 and 17 are similar to Figure 12 and shown in section differently constructed side posts.

The automobile body shown in Figures 1 to 5 of the drawings constitutes a self-supporting body consisting of a plurality of interconnected parts, which are pressed individually of laminated materials impregnated with artificial resin and which are interconnected by a metal framework. This metal framework is formed of box-like section supports consisting of pressed interconnected sheet bars. The supports are all connected with each other and constitute a skeleton framework.

The drawings show a roof **15** having the form of a tub and pressed of one piece from the impregnated material. The lower connecting edge of the roof **15** is provided with an outer bead-like flange **16** (Fig. 2) which extends around the roof. The flange **16** which is thicker than the other portions of the roof **15**, is integral with these portions and is formed during the same pressing operation during which these portions are formed. The flange **16** may be formed of strips of impregnated material applied to the roof part prior to the pressing operation, and pulverized artificial resin binders may be added to the roof material before the pressing takes place.

Another method of manufacturing the thick flange **16** consists in applying less pressure to the edge than to other portions of the roof part. In that case, it is not necessary to add any additional materials to the roof part, and the greater thickness of the flange **16** is produced merely by subjecting the flange to a smaller force during the compression.

Since the strips which are saturated with artificial resin and which constitute the laminated part extend to the lower edge of the roof part, a roof is produced after the compression, which is of substantially the same firmness in all its portions.

The roof **15** is connected with the other parts of the automobile body by means of a connecting flange **17** of the roof support **18**. In the construction shown in Figure 2, the roof support **18** has the form of a box in cross-section and consists of steel bars forming a supporting structure for the automobile body. However, the support **18** may be of any other suitable cross-sectional form. The steel bars consist of a plurality of section sheets which are soldered together. One of these sheets is provided with a U-shaped extension constituting the connecting flange **17**, which receives the flange **16** of the roof **15**.

In accordance with the present invention, the flange **17** is bent over the thick flange **16** of the roof, so that a close and firm connection is attained. In mass production, the bending over of the flange **16** is preferably carried out by intermittent blows exerted by compressed air hammers.

If necessary, suitable sealing means, such as a thin layer of rubber **90^{I}**, may be inserted between the two flanges.

The windshield glass **19** is enclosed on all sides by a profiled rubber frame **20**. The upper horizontal edge of the frame **20** is held firmly between the adjacent forwardly projecting edge of the roof (Fig. 2) and a ledge **21** which is attached to the frame **13**.

The forward part or cowl **22** of the automobile body, which is situated below the windshield **19**, is connected to a box-like transverse support **23**. This support is composed of two U-shaped

pressed sheets, the legs of which are soldered to each other at their contacting surfaces.

The legs **24** and **25** which are situated directly below the windshield **19**, are so formed that the free edge of the leg **24** constitutes a flange **26** which is bent over the thick flange or edge **27** of the forward body part **22**, while the member **25** also serves as a support for the instrument board **28**.

The roof **15** is attached to the sides of the automobile body and to its rear in a substantially similar manner. As shown in Figure 3, each side of the roof is supported by a flange **29** which is bent over the flange or edge **16** of the roof **15**. The flange **29** constitutes a part of the longitudinal beam **30** of the automobile roof.

The side window **31** of the automobile is held in an elastic frame **32** the upper horizontal part of which is held between the beam **30** and a ledge **33**. A stick **34** projects into the beam **30** and is used for holding the inner roof covering **35**.

The manner in which the windshield post **36** is constructed and supported is shown in Figure 4. The post **36** consists of a pressing which is substantially U-shaped in cross-section and which is open toward the interior of the body. The two legs of the U have free ends constituting flanges or thick edges **37** and **38**.

A connecting flange **39** constituting a part of a supporting bar **40**, encloses the flange **37** of the post **36**. The other end of the bar **40** projects into the rubber frame **20** and has the form of a flange **41** embracing the edge **38** of the post **36**.

The bar **40** can have any desired form, particularly as far as its cross-section is concerned, and also serves as a support for the door packing **42**.

The door **43** of the automobile body carries a frame **44** for the door window **45**. The frame **44** engages the elastic member **42** when the door is closed.

The end **50** of the automobile side wall **46** which is situated close to the door **43**, is bent inwardly to a slight extent to constitute an abutment for the adjacent end of the door. The end **50** is strengthened by a somewhat thickened edge or flange **48** which extends vertically and constitutes an outwardly projecting element. A connecting flange **49** constituting a part of the metallic post **47** is bent around the projecting flange **48**.

The metallic post **47** which has the form of a box in cross-section, is so formed that it provides a tight fit in relation to the end **50** of the side-wall **46**.

Figure 5 shows the manner in which the side wall **46** is attached to the floor of the automobile body. The floor is carried by longitudinal side supports **51** which have the form of a box in cross-section. Each support **51** is formed of a sheet **52** which is bent in the form of a step and a sheet **53** which is inclined downwardly and which is connected with a vertical sheet **54**, whereby a quadrilateral body is formed.

The lower edge of the sheet **53** is bent to form a flange **55** which received the beaded edge or flange **56** of the side wall **46**. The flange **55** is bent around the edge **56**.

The automobile body shown in Figures 6 to 10 of the drawings is substantially similar to the one described.

This body includes a roof **60**, windshield posts **61**, a front part or cowl **62**, side walls **63**, and doors **64**. The frame **65** which carries the windshield **70**, is made of rubber and its upper portion is supported by a bar **66** which is triangular in cross-section, as shown in Figure 7. A ledge **67** is attached to the bar **66**, one end of which forms a flange **68** which is bent around a bead-like edge **69** of the roof **60** and a rubber layer **91**[I].

The lower edge of the windshield frame **65** is supported by a transverse support **71** which consists of a single outwardly open U-shaped metal sheet. The end **72** of the bent sheet **71** is bent around the bead-like edge **73** of the cowl **62**. The support **71** also carries the dashboard **74**.

As shown in Figure 8, the side edges **75** of the roof **60** may be bent upwardly to constitute a rain-collecting gutter and may be enclosed by a flange **76** of the longitudinal support **77**.

As in the previously described construction, the windshield post **61** is connected with a metallic support **78** and its edges **79** and **80** are held by flanges **81** and **82** of the support **78**, (Fig. 9). The support **78** also carries a packing **83** for the door **64**. The door **64** carries a frame **84** for the door window **85**.

As shown in Figure 9, the side wall **63** of this construction is straight and its edge **86** is enclosed by a flange **87** of the post **88**.

As shown in Figure 10, the longitudinal floor support **89** is triangular in form and constitutes a closed body, the flange **90** of which is bent around the lower edge **91** of the side wall **63**.

The automobile body shown in Figures 11 to 14 includes a cowl **101**, a rear part **102**, two side parts **103**, two side posts **104** and a roof **105** (Fig. 11). The roof is pressed as a single body and its front constitutes the upper edge of the windshield frame, while its rear is mounted directly upon the rear part **102**.

These body parts constitute a rigid body structure and at those zones where they are subjected to the greatest possible strain, they are strengthened by a simple metallic framework similar to a bridge structure. The metal frame includes two longitudinal supports **106** each of which extends upon one side of the vehicle body close to a side edge of the roof. The front portions of the supports **106** may serve as posts for the windshield frame, while the rear ends of the supports extend to the floor of the vehicle and may be used for strengthening the fenders and seat supports. However, the main purpose of the supports **106** is to strengthen the edges of the roof **105**, so that the roof along with the cowl **101** and the rear post **102** constitutes a firm base of the body structure.

The longitudinal supports are connected with each other by transverse struts **107** and **108**. The strut **107** extends along the front edge of the roof and carries profiled flanges which may be connected with a rubber frame carrying the windshield glass **150**. The transverse strut **108**, which may be dispensed with entirely, constitutes, preferably, a continuation of the side posts **104**.

Due to the provision of side posts **104** cooperating with the edges of the roof **105**, which are strengthened by the longitudinal supports **106**, the walls of the side parts **103** extend only as far as the side windows **118**. This makes it possible to eliminate large press molds which were used heretofore for the pressing of side parts which included the side window frames.

Figure 12 illustrates the portion of a side post **104** below the window **118**. The post **104** is formed by two profile bars or struts **109** and **110** having bent portions **111** and **112** which clamp the edge **113** of the side part **103**. The edge **113**

is bent inwardly in relation to the side wall **103** and is of the same thickness. Screws **114** are preferably used for holding or tightening the edge **113**. Thus the side part **103** is held firmly by the post **104**.

Obviously, the screws **114** may be substituted by rivets or the like.

The side post **104** is shaped to constitute an abuttment for the adjacent end of the door **115**. However, the post **104** may carry hinges for the door **115**.

Figure 13 shows the shape of the side post **104** above the side port **103**. The edges **111** and **112** of the profiled struts **109** and **110** are firmly connected with each other. The abutting flanges **116** which form the second connection between the struts **109** and **110** are located substantially in the middle of the post **104** above the side part **103**, so that these flanges can be used for holding the rubber frame **117** of the side window **118**. The outer surfaces of the post **104** extending above the side part **103** may be provided with a coating **119** consisting of materials impregnated with artificial resin.

The coating **119** may be applied directly upon the post **104** or, if the edges **111** and **112** are of a somewhat different form, only the strut **110** of the post **104** may be provided with the coating **119**.

The shape of a longitudinal support **106** and its connection with a side edge of the roof **105** are shown in Figure 14. The support **106** has the form of a sector in cross section and consists of a curved bar **128** and a supporting bar **129** provided with a flanged edge **131**.

The edge **131** is firmly connected with an edge of the curved bar **128**. Another edge of the bar **129** consists of an upwardly turned outwardly projecting flange **132** which constitutes a rain gutter.

The roof **105** is provided with a downwardly projecting portion **133**. The surfaces of the edge of the roof **105** and of the projection **133** en-enclose a space **134**. The support **129** is slightly bent downwardly close to the space **134**. Due to this arrangement, rain is prevented from penetrating into the interior of the structure, so that the inner portions of the support **106** are protected against rust.

The support **106** is connected with the roof **105** by screws **135** extending close to the space **134**.

The bar **128** has a downwardly and outwardly projecting edge **136** which is used for holding a rubber packing **137** for the door window.

An edge of the support **129** may be bent in a similar manner for holding another rubber packing for the side window **118**. Figure 14 also shows the connection of a side post **104** with the edge of the roof **105**. This attachment is carried out by means of flanges **138** constituting a bent portion of the struts **109** and **110** of which the post **104** is composed. The flanges **138** are soldered to the support **129** on the one hand, and on the other hand, they are connected to the roof **105** by the screws **135**.

The described metal supports increase the strength of the automobile body to a great extent, while the body parts may be made quite thin. This diminishes the weight of the body and the time required for the hardening of the body parts.

Figure 15 shows a side post **209** of a different and somewhat simpler form. The post **209** consists of a single profiled rod which is connected with a side wall **203** having a bent edge **213**, by means of a bent insert or flange **220** and screws **214**. In order to strengthen the post **209**, its interior is covered by a layer **221** consisting of artificial resin materials.

Obviously, the same coating may be provided upon the outer surfaces of the post **209** as well.

Figure 16 shows a side post **304**, the outer surfaces of which, situated within the door frame, carry a layer of artificial resin.

The post **304** includes a strut **309** made of a steel sheet and connected with an aluminum strut **391**, the purpose of which is to provide a good support for the artificial resin layer **322**. The struts **309** and **391** may be rolled together in the cold state, or they may be connected with each other by rivets or by the bending of their edges. If rivets are used, the rivet holes must be sufficiently large to enable a shifting of the struts **309** and **391** relatively to each other.

The second strut **310** constituting a part of the post **304** is similar to the strut **110** of Figure 12, but is provided with an outwardly bent flange **321**. The side wall **303** of the automobile body is provided with a bent portion **313** which is clamped between the flange **321** and a flange **311** of the strut **309** by bolts **341**.

In the construction shown in Figure 17, the side post **404** consists of a single bent metal sheet **423** having outwardly projecting edges **424** constituting an abuttment for the door **415** and carrying a door packing **425**. A coating **426** consisting of laminated materials impregnated with artificial resin is used to hold the packing **425**. In this construction, the side wall **403** of the automobile body is attached to the side post **404** by means of a connecting flange **430**.

The post **404** may be made wider above the flange **430**, i. e. above the lower edge of the window, and may occupy the space enclosed by the broken line **427**.

If the connection between the wall **403** and the post **404** is carried out by means of the bent edge **413**, instead of the flange **430**, then the entire post **404** from top to bottom should have the shape indicated by the line **427** and should be made similar to the post **104**, shown in Figure 12.

It is apparent that the specific illustrations shown above have been given by way of illustration and not by way of limitation and that the structures above described are subject to wide variation and modification without departing from the spirit and scope of the present invention. All of such variations and modifications are to be included within the scope of the present invention.

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MAY 25, 1943.	VEHICLE BODY	**391,888**
BY A. P. C.	Filed May 5, 1941	6 Sheets-Sheet 1

Fig. 1.

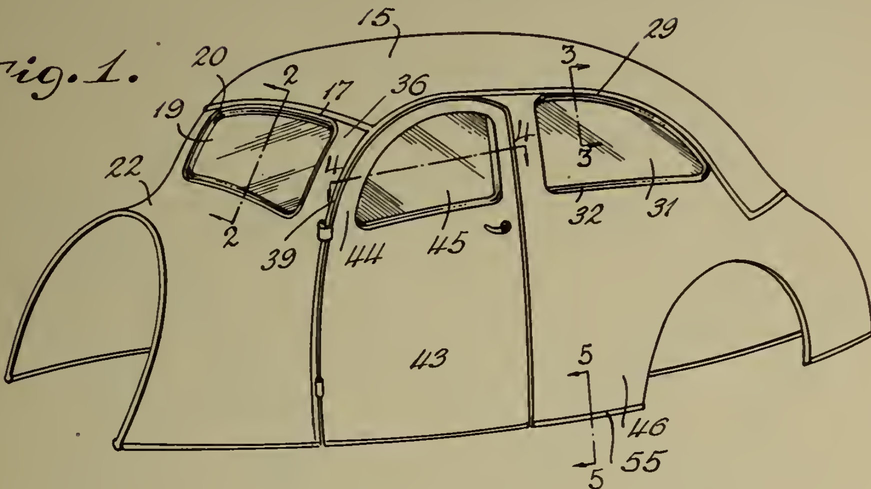


Fig. 4.

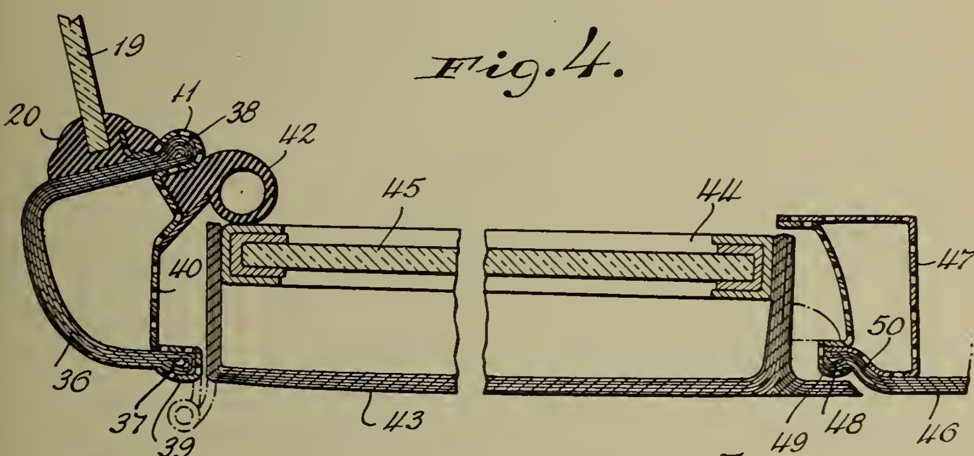
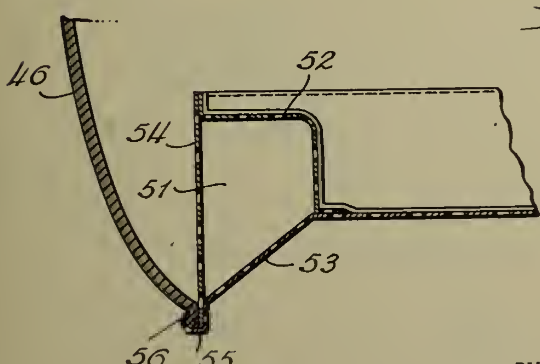


Fig. 5.



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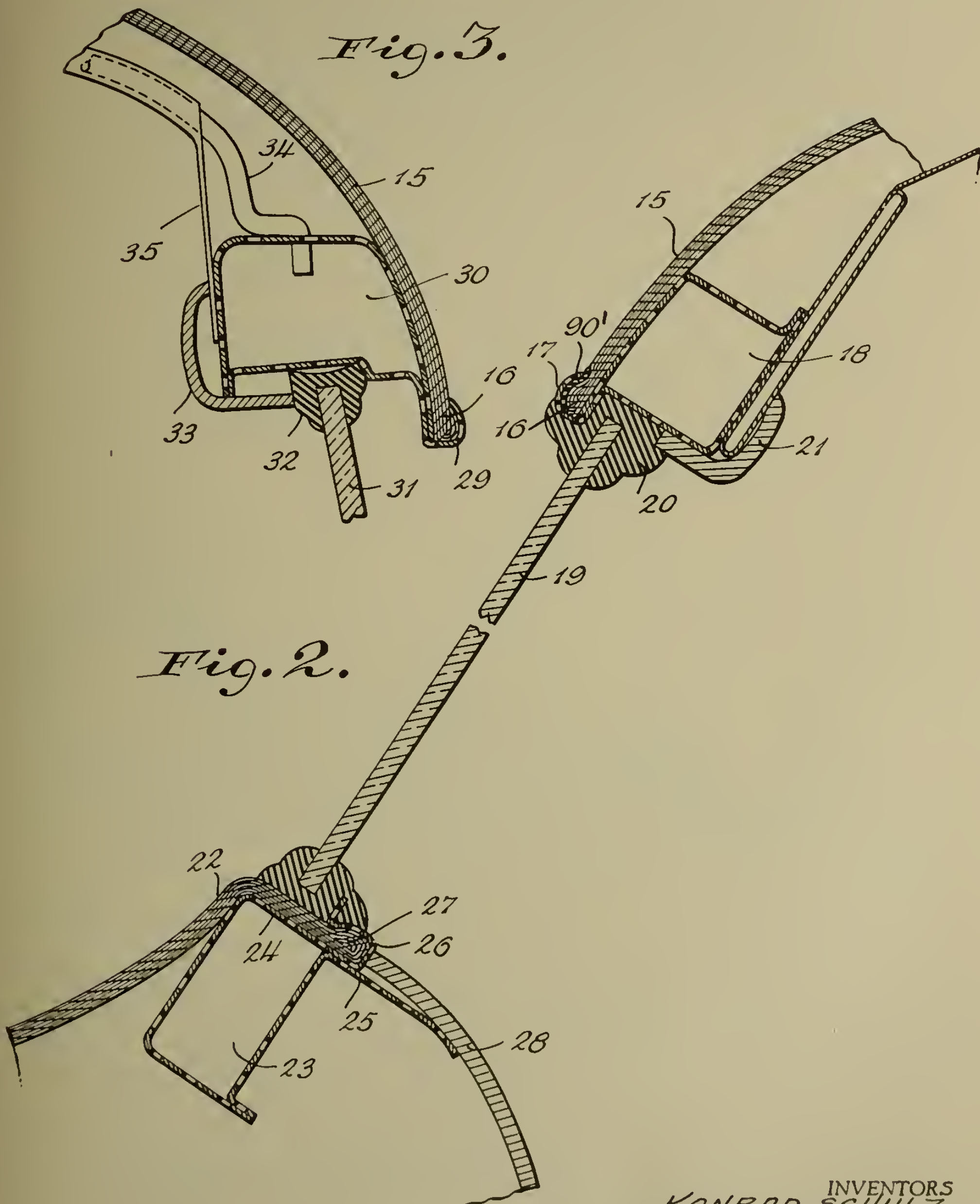

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Fig. 6.

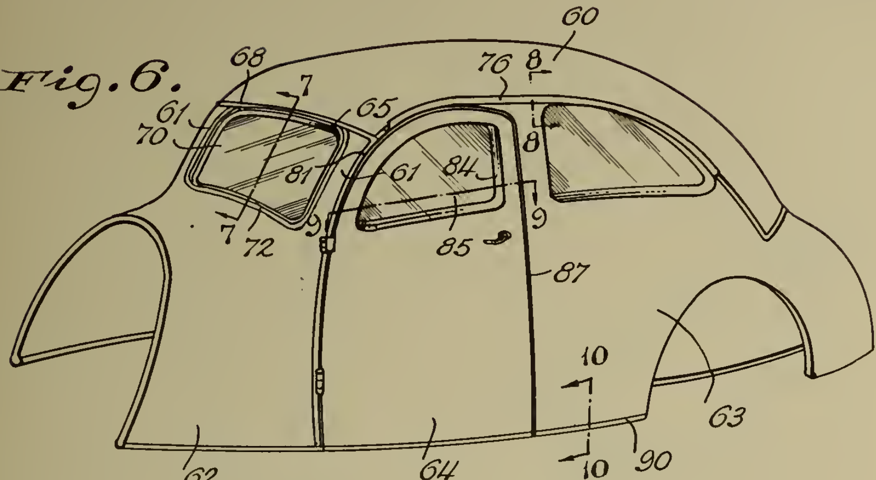

Fig. 9.

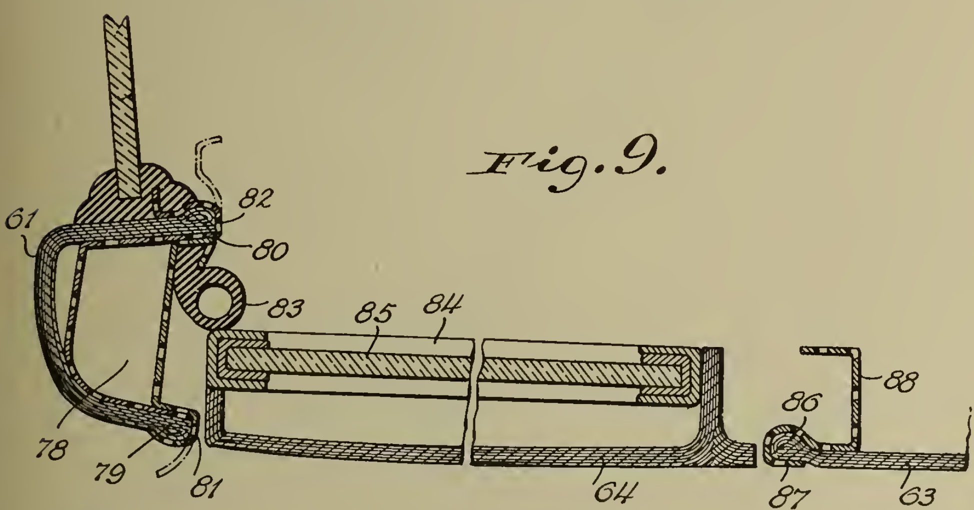

Fig. 10.

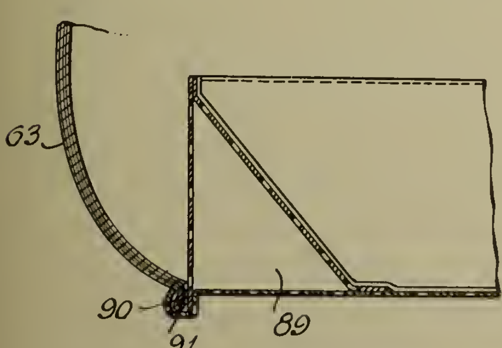

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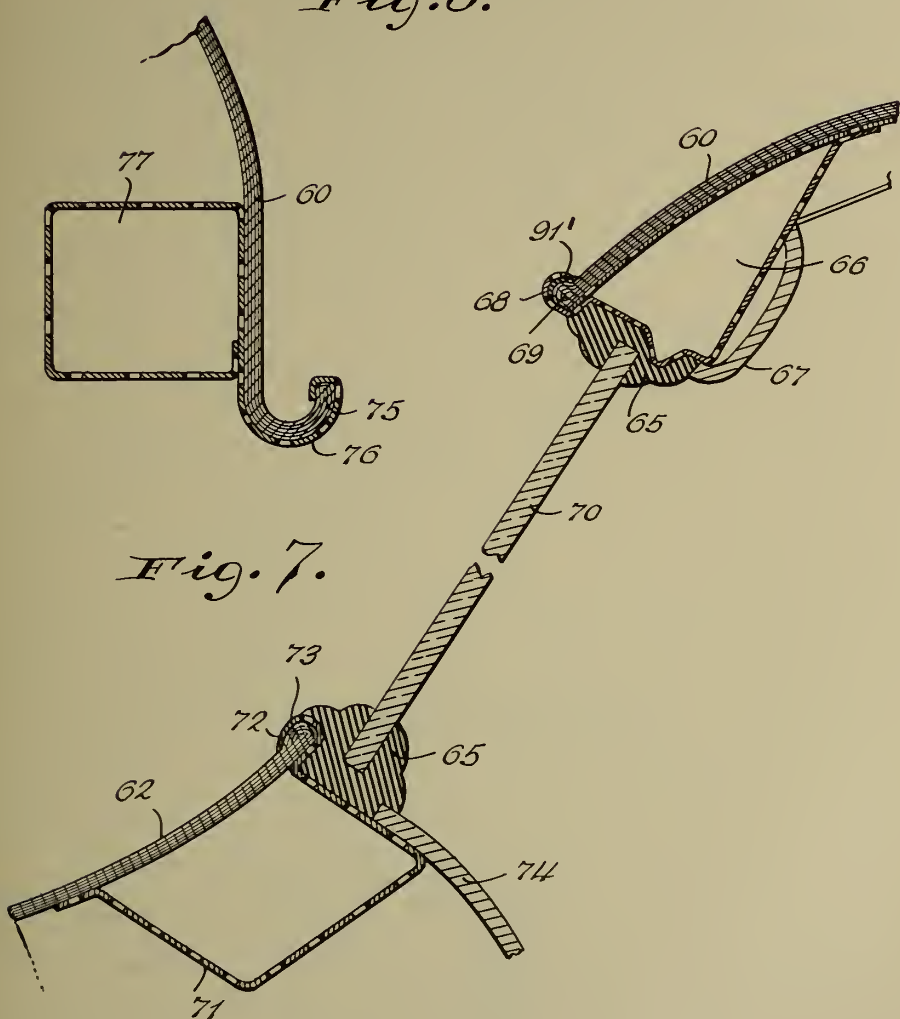
Fig. 8.

Fig. 7.



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PUBLISHED
MAY 25, 1943.
BY A. P. C.

K. SCHULZ ET AL
VEHICLE BODY
Filed May 5, 1941

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391,888
6 Sheets-Sheet 5

Fig. 11

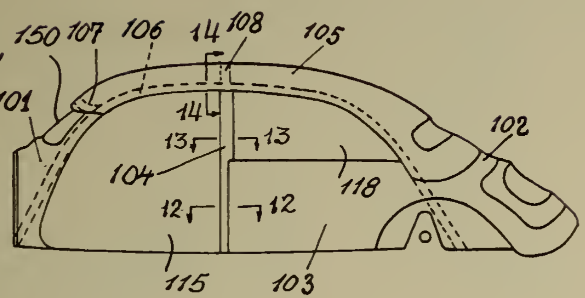

Fig. 12.

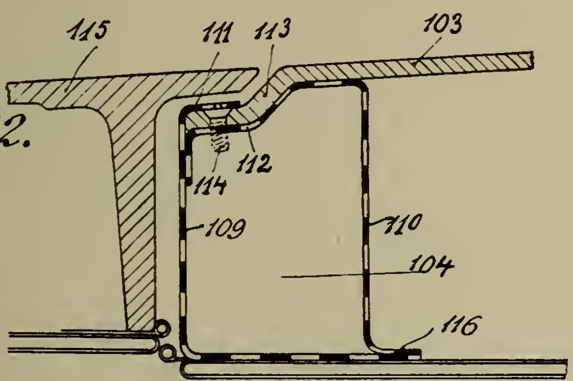

Fig. 13.

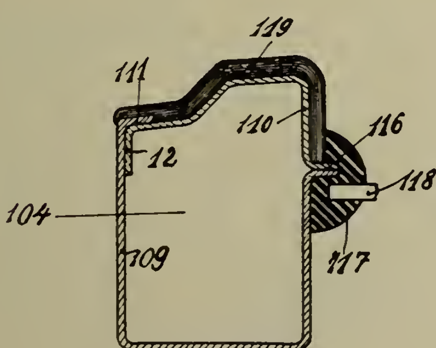

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Fig. 15.

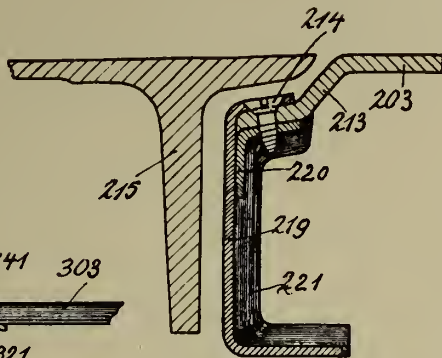


Fig.16.

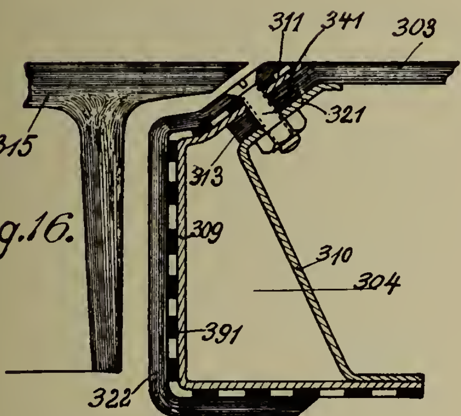


Fig.17.

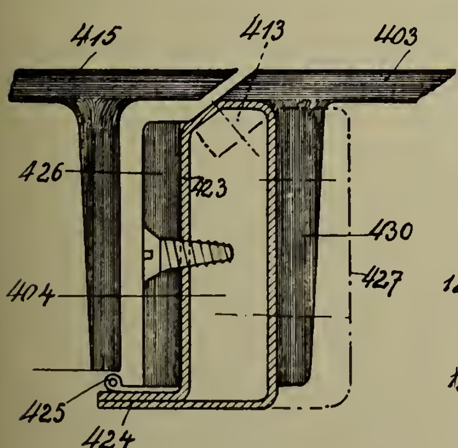
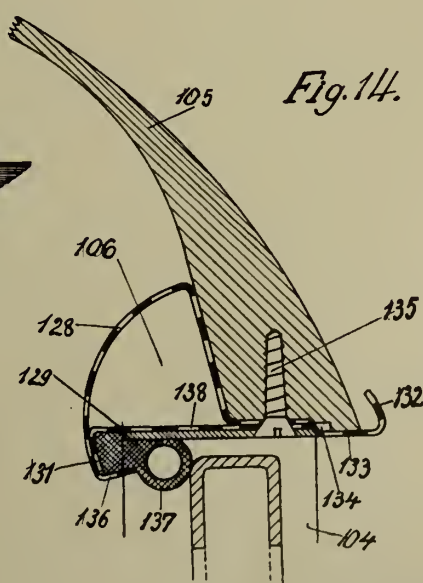


Fig.14.



INVENTORS
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Published May 25, 1943

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ALIEN PROPERTY CUSTODIAN

CARBURETTERS OF THE FUEL INJECTION TYPE

Marcel Louis Mennesson, Neuilly-sur-Seine, France; vested in the Alien Property Custodian

Application filed May 5, 1941

The present invention relates to carburetters of the fuel injection type, that is to say carburetters without a float chamber and capable of working in all positions, in which carburetters fuel is injected under the action of a pressure which varies automatically and in accordance with the pressure existing in the intake conduit before the throttle means (butterfly valve) which determine the useful section of flow of said conduit. The invention is more especially, although not exclusively, concerned, among these carburetters, with those intended for the feed of airplane engines, and engines for vehicles intended to move over very rough ground.

The object of the invention is to provide a carburetter of this type which is better adapted to meet the requirements of practice than those made up to the present time.

According to a first feature of the present invention, the injection pressure is modified, in a carburetter of the type above referred to, through the use of stopping means (a valve) operative by a movable or deformable member, such as a membrane for instance, so as to have said means opened by the suction existing in the engine intake conduit before the throttle means, and closed by the pressure under which the fuel is fed, the action of the suction being transmitted to said member through a second deformable or movable member, and this second mentioned member is given an active area greater than that of the first mentioned member, so as to multiply the effect of the force by means of which the injection pressure is varied, the effect due to the suction acting preferably simultaneously on both of the members above mentioned the active surfaces of which are different.

According to a second feature of the invention the carburetters of the type above mentioned are provided with means for automatically modifying the conditions of carburation in accordance with the load of the engine to be fed.

According to a third feature of the present invention, which relates more particularly to the preceding feature, the engine is fed with fuel through at least two fuel jets one of which serves to the feed when the engine is running under small loads, while the feed of the engine running under higher loads is ensured through the other jet or jets, the output of which is substituted or added, preferably in an automatic manner, to the output of the first mentioned jet.

According to a fourth feature of the present invention, which relates more especially to the preceding feature, means are provided for increasing the injection pressure when passing from operation under high loads to operation under small loads.

According to a fifth feature of the present invention, which relates more especially to the preceding feature, the system of jets is provided with means for automatically ensuring the distribution of the outputs of said jets, preferably under the control of the suction existing at a point of the engine intake conduit, either before or behind the throttle means, or under the control of the suctions existing respectively and simultaneously at several points of said conduit, before and/or behind said throttle means, or at points which are either before or behind said throttle means according to the position of said means.

According to a sixth feature of the present invention, which is more especially used in connection with the preceding feature, the deformable or movable member (membrane) above mentioned which is subjected to the action of the suction or suctions to be considered is arranged in such manner that it can serve temporarily to increase the injection pressure when it suddenly causes a change from "operation under small loads" to "operation under high loads."

According to a seventh feature of the invention, I adjoin to the means for obtaining a suitable distribution of the outputs of the feed jets, means responsive to pressure variations, such as a barometric box, for limiting the action of the first mentioned means when the air intake pressure to the carburetter decreases.

According to an eighth feature of the invention, the means operatively connected with the stopping means (valve) for obtaining a variation of the injection pressure are associated with an elastic element (such for instance as a spring) which is brought into and out of action by a distinct maneuvre and/or by the operation of the throttle means (butterfly valve) when the latter is close to the position in which it is fully opened so as to give the maximum of power of the engine, with a view to temporarily increasing the injection pressure and, consequently, the percentage of fuel in the mixture when the engine is to work under certain particular conditions.

According to still another feature of the present invention, I provide, in the conduit through which is transmitted the suction which controls the injection pressure, at least one orifice opening into the atmosphere or communicating with the air intake of the carburetter.

According to still another feature of the invention, I provide, in the conduit through which is

transmitted the suction which controls the injection pressure, at least one orifice adapted to be placed in communication, either with the atmosphere or with the air intake of the carburetter through stopping means (such as a needle valve for instance) controlled by pneumatic means (membrane or manometric box) placed in a medium where the pressure is substantially equal to that existing at the intake of the carburetter, in such manner that this orifice is opened when said pressure drops below a predetermined value, and is closed when said pressure becomes equal to said value or exceeds it.

Other features of the present invention will result from the following detailed description of some specific embodiments thereof.

Preferred embodiments of the present invention will be hereinafter described, with reference to the accompanying drawings, given merely by way of example, and in which:

Fig. 1 is a diagrammatic vertical section of a fuel injection carburetter made according to a first embodiment of the present invention;

Fig. 2 is a similar view of a carburetter made according to another embodiment of the invention.

In order to make a carburetter according to the invention, the general structure of the carbureter proper is of any suitable type which is adapted to the fed of an engine by injection of fuel without a float chamber, and which is capable of working in any position.

This carburetter includes a body 1, in which the gases flow, for instance, in the upward direction, as shown by the arrows of Figs. 1 and 2. A throttle valve 2 is provided in said body and it is operated from a distance through control means 3. A choke tube 4 communicates with the air intake of the carburetter, and at least one Venturi-shaped nozzle 5 opens into the body 1 of the carburetter, preferably behind throttle valve 2.

Concerning the means for controlling the amount of fuel to be fed into the carburetter, they constitute a control system which is for instance mounted laterally on the body 1 of the carburetter (on the right hand side thereof on the drawing).

To this control system, I connect a pipe 6 for the feed of fuel under pressure, supplied by a pump or any other suitable source capable of providing the desired, pressure, preferably uniform. This pipe 6 opens into a chamber 7 through an orifice 8 the edges of which form a seat for a valve 9. The wall of chamber 7 opposite valve 9 is constituted by a flexible membrane 10 or the like, connected to said valve by a rod 11. This chamber 7 is connected, through a passage 12, with a chamber 13 intended to feed a jet 14, constituted, for instance, by a calibrated, orifice, which opens outwardly opposite the inlet of the Venturi-shaped nozzle 5 above mentioned and preferably at a short distance from this inlet. The interval existing between jet 14 and Venturi tube 5, which interval is in the atmosphere, is such that the jet in question is not subjected to the action of the suction existing in the body 1 of the carburetter.

The pressure at which the fuel is injected into body 1 depends upon the position occupied by valve 9 with respect to its seat, and this pressure will be the higher as valve 9 is more widely opened. As valve 9 is connected with membrane 10 or the like, its position depends upon the deformation of said membrane, and this deformation should be such that it depends upon the suction existing in tube 4 when the engine is working. It is known that this suction is the higher as the speed of the engine is higher and throttle valve 2 more widely opened.

In order to subject membrane 10 to the action of this suction, I provide, in the body 15 of the control system, a chamber 16, adjoining chamber 7 so that membrane 10 constitutes a movable partition between said chambers 7 and 16, and the wall of chamber 16 which is located opposite membrane 10 is constituted by a second flexible membrane of the like, designated by 17, which is also fixed to the rod 11 of valve 9. The second mentioned chamber 16 is connected through a conduit 18 with a chamber 19 which communicates, through an outlet 20, with tube 4 at the point thereof where the suction is maximum when the engine is running. Chamber 19 may communicate, on the other hand, through a calibrated orifice 21, with the atmosphere or the air intake of the carburetter.

In the wall of chamber 19, I may, advantageously, provide an orifice 22 adapted to be closed by a spring valve 23 fixed to a flexible membrane 24 which constitutes the movable or deformable wall of a box 25 connected through a tube 26 with the body 1 of the carburetter behind throttle valve 2. Membrane 24 is also subjected, on the outer face thereof, to the action of the atmospheric pressure or of the carburetter air intake pressure. The opposite face is subjected to the combined actions of the return spring of valve 23 and of the suction existing in the carburetter body behind throttle valve 2.

In the body 15 of the control system, I provide, adjacent the second mentioned chamber, to wit 16, a third chamber 27, whereby membrane 17 forms a deformable partition between said chambers 16 and 27. This chamber 27 is connected, through a calibrated orifice 28, with the atmosphere or with the air intake of the carburetter. Thus the pressure in this chamber 27 is higher than in the second chamber 16 when the engine is working, since the pressure in chamber 16 is then equal to the suction transmitted from tube 4 through chamber 19 and conduit 18.

It follows that membrane 17 undergoes, under the effect of these differences of pressure, a thrust toward the left (in the arrangement disclosed by Figs. 1 and 2) which moves in the same direction membrane 10 and, consequently, valve 9 which is thus moved more or less away from its seat. Consequently, the fuel supplied under pressure through pipe 6 is admitted under a high pressure into chamber 7 and penetrates, after having flown through passage 12, into chamber 13, from which it is injected through jet 14 into Venturi nozzle 5 and the body 1 of the carburetter. The fuel thus injected is then mixed with the air admitted into body 1 through tube 4 and forms the fuel mixture which is to be fed to the engine.

However, the inflow of fuel into chamber 7 exerts a pressure on membrane 10 and when the latter undergoes from the fuel a thrust higher than that exerted on membrane 17 by the pressure of the air admitted through calibrated orifice 28, both of the membranes, which are connected together by rod 11, are moved toward the right so as more or less to close valve 9.

For a given suction transmitted to chamber 16 from tube 4, the pressure in chamber 7 assumes a given value which determines the fuel injection, whereby a correct composition of the fuel mixture is obtained for all velocities of the air

stream flowing through tube 4 and consequently for all speeds of the engine.

It is known that the suction in tube 4 drops to a very low value when the engine is running at low speed and throttle valve 2 is but little opened, more especially when the engine is idling on no load.

Under these conditions, the injection pressure is also very low and the possible inclinations of the carburetter, same as the accelerations to which might be subjected the leaking liquid which flows therethrough might vary to a considerable degree the injection pressure adjacent jet 12. This would involve considerable differences in the compositions of the fuel mixture fed to the engine and, as a consequence, serious perturbations in the working of said engine.

In order to obviate this drawback and according to the invention, membrane 17 is made of an area much greater than that of membrane 10, whereby the injection pressure is multiplied to a considerable amount since this pressure P, for a suction h in tube 4, becomes equal to

$$h\frac{(S-s)}{s}$$

S and s designating the active surfaces of membranes 17 and 10, respectively.

With such an arrangement, it is possible to obtain a very high pressure of injection which keeps a sufficient value, for certain applications, at low speeds of the engine.

However, an arrangement such as above described does not work with sufficient safety when it is mounted on vehicles capable of moving with very great inclinations on the horizontal, such as aircrafts, and more especially airplanes, or vehicles intended to run on very rough ground.

For these particular uses, the device according to the invention might be defective for small openings of throttle valve 2. In order to obviate this drawback, the fuel feed means of the injection carburetter is arranged in such manner as automatically to substitute for the feed device adapted to work under high power conditions, a feed device especially intended for running under small loads, by calling into play, on the one hand, a jet of small section, and, on the other hand, a modification of the injection pressure conditions.

This result is obtained, in the simplest manner, as shown by Fig. 1, by adjoining to the main jet 14 an auxiliary jet 29, of reduced section, which affords a permanent communication between chamber 7 and chamber 13 in addition to the communication supplied by passage 12, both of the jets working, in series with each other, in this embodiment, especially for small loads of the engine.

The substitution to the feed device including jets 12 and 14, for high power working, of the feed device including auxiliary jet 29, for working under small loads, and vice-versa, is obtained by means of a slide valve 30 movable in a housing provided in the body 15 of the control system. This slide valve is so devised that it can be displaced, opposite passage 12, so as to stop or to open this passage. When passage 12 is opened, chamber 13 is fed chiefly through passage 12 and accessorily through auxiliary jet 29, and this corresponds to high power working of the engine. On the contrary, when passage 12 is closed, the whole of the fuel fed to chamber 13 passes through jet 29, in series with main jet 14, the engine then running under small loads.

The displacements of the slide valve may be controlled through a return spring 31 and a bell-crank lever 32, pivoted at a fixed point 33 and actuated by a push piece 34 rigid with a membrane 35 which forms a partition between two compartments 36 and 37 of a chamber located adjacent to chamber 27, above mentioned. A return spring 38, housed in compartment 36, acts on membrane 35 in a direction tending to place push-piece 34 out of contact with bent lever 32.

Compartment 36 communicates, through tube 39, with the body 1 of the carburetter, and this:

a. either, as shown by Fig. 1, through an outlet 40 opening into said body behind throttle valve 2;

b. or through an orifice 41 located close to throttle valve 2 but behind the latter when the throttle valve is closed;

c. or again, as shown by Fig. 2, simultaneously through orifices 40 and 41 located as above set forth.

The other compartment 37 communicates, in a permanent way, through at least one orifice 42, with chamber 27.

Instead of having jets 14 and 29 working in series, as shown by Fig. 1, they might also be mounted in parallel, these jets cooperating with stopping and distributing means such as a slide valve adapted to close one of the jets while opening the other and vice-versa. I might also, as shown by Fig. 2, provide a main jet, adapted to be fed by passage 12 and both of the auxiliary jets 29^1 and 29^2, jet 29^1 being adapted to work alone when the engine is running under small loads, while both of the jets are in operation, eventually together with passage 12, for feeding fuel to the main jet, when the engine is to run at full power.

In the embodiment of Fig. 1, slide valve 30 has been shown in the position it occupies when the engine is running at full power. In this case, chamber 7 feeds fuel to chamber 13 and consequently to the main jet 14 through passage 12, of relatively large cross section, and accessorily through jet 29 of small section.

When slide valve 30 is displaced upwardly by lever 32 under the action of membrane 35, as it will be hereinafter explained, said slide valve stops passage 12 and the feed of fuel takes place only through auxiliary jet 29.

As the section of flow is reduced, it is clear that, in order to maintain the proper percentage of fuel in the mixture, it becomes necessary to increase the injection pressure to a substantial degree.

For this purpose, chamber 16 communicates through a conduit 43 with a chamber 44 provided laterally on the body 1 of the carburetter. This chamber communicates with the inside of this chamber through orifices such as 45 and 46 which are located close to the edge of throttle valve 2. Chamber 44 is eventually connected also through a calibrated orifice 47 with the atmosphere or with the air intake of the carburetter. The passage of fluid, through conduit 43, is controlled by slide valve 43 which is provided, for this purpose, with a peripheral groove 48 adapted to come into register with conduit 43 when passage 12 is stopped by slide valve 30. On the contrary, when this passage 12 is opened, the groove in question is located at a distance from conduit 43, and this conduit is stopped, either wholly or partly, by slide valve 30.

Chamber 44 is provided with at least one orifice 45 located behind throttle valve 2, that is to say in a medium where the suction is high when

the throttle valve is but little open and therefore there is but little suction in tube 4.

In order to obtain a suitable injection pressure for each position of throttle valve 2 within the limits of operation of the device when working under small loads, I provide at least one orifice 46 which passes from before to behind throttle valve 2 at the beginning of the opening movement of said throttle valve.

The suction existing in the body 1 of the carburetter close to orifices such as 45 and 46 is transmitted to chamber 44 and through conduit 43 to chamber 16 so as to act on membranes 10 and 16 in addition to the suction transmitted through conduit 18 so as to produce a suitable opening of valve 9.

The location of the orifices such as 45 and 46, same as their section or their outline, permit of obtaining correct curves of injection pressure and, therefore, correct curves of carburation when the engine is running under small loads.

Membrane 35 is used for displacing slide valve 30 through the intermediate of lever 32. This membrane 35 is subjected, on the face thereof which limits compartment 36, to the action of spring 38 and to the suction transmitted through tube 39. The other face of this membrane, which limits compartment 37 is subjected to the action of the pressure existing in chamber 27 which, as above stated, communicates through orifice 28 with the atmosphere or with the carburetter air intake.

Spring 38 is given a strength such that the force exerted on membrane 35 by the difference of the pressures existing respectively in compartments 36 and 37, when the engine is idling or is subjected only to a small load, overcomes the action of spring 38. Consequently, membrane 35 is moved toward the right of Fig. 1 so that push piece 34 comes into contact with lever 32 which, when pivoting, pushes slide valve 30 until the latter occupies a position in which it closes passage 12 and opens conduit 43.

When the suction existing in the body 1 of the carburetter behind throttle valve 2 drops below a given value, the reverse operations take place, that is to say slide valve 30 comes back to the position shown by Fig. 1.

When the suction, transmitted through tube 39, acts through orifice 40, the displacements of slide valve 30 take place in accordance with the pressure existing in the intake conduit of the engine, since this orifice is located at a substantial distance from throttle valve 2. On the contrary, when the suction acts through orifice 41 (and no longer through orifice 40), the displacements of slide valve 30 also take place, at the beginning, in accordance with the pressure variations in the intake conduit of the engine, i. e. as long as orifice 41 remains behind throttle valve 2. But as soon as this orifice becomes located ahead of the throttle valve, the sudden drop of pressure brings into play the conditions of operation corresponding to "working under power conditions" whatever be the suction in the intake conduit. The displacements of slide valve 30 therefore take place, in this case, in accordance with the value of the suction in the part of the carburetter body behind the throttle valve for the displacements thereof corresponding to small loads and, furthermore, in accordance with the position of throttle valve 2 with respect to orifice 41.

In addition to its action for producing displacements of slide valve 30, membrane 35 is adapted to act for increasing the percentage of fuel in the fuel mixture. As a matter of fact when passing from working conditions under small load to power working conditions, membrane 35 moves suddenly toward the left in chamber 36—37.

A portion of the air present in compartment 37 escapes through orifice 42 into chamber 27, which temporarily increases the pressure in said chamber and exerts a thrust on membrane 17, which corresponds to an increased opening of valve 9 and temporarily increases the percentage of fuel in the fuel mixture. The value of this increase of pressure and its duration are determined by the section of orifice 28.

In the example above described, the factor which determines the injection pressure when running under small load conditions is the suction existing in chamber 44. However, even under these conditions, device 19—18, through which the suction which determines the power working conditions is acting, is left in operation. However, it should be well understood that I might, through a slide valve or in any other way, temporarily stop tube 18 when passing from power working conditions to small load working conditions. When it is desired to modify the carburation curve, as resulting from the means above described, I may use the arrangement according to Fig. 2, which includes a second auxiliary jet 29^2.

In this case, the operation of the carburetter is as follows:

When the engine is idling or running under small loads, the suction existing behind throttle valve 2 is very great. This suction is transmitted, preferably through orifices 41 and 40 and tube 39, to compartment 36. Membrane 35 is pushed to the limit toward the right against the action of spring 38 and slide valve 30 stops channel 12 and jet 29^2. The feed of fuel is ensured only through jet 29^1 and the injection pressure depends upon the suction existing in box 44 since the groove 48 of slide valve 30 is located opposite conduit 43.

When, as a consequence of the partial opening of throttle valve 2, orifice 41 passes before said valve, the suction in chamber 36 is suddenly reduced and membrane 35 is moved toward the left, being limited in its displacement by a push-piece 49 (position shown by Fig. 2) which bears against the partition 30 provided between chamber 27 and compartment 37 provided that the action of the suction opposite orifice 40, to which is added that of spring 51, has kept a value sufficient for overcoming the action of spring 38.

As a consequence of this partial displacement of membrane 35 toward the left, I obtain a corresponding displacement of bell crank lever 32 under the effect of the expansion of the return spring 31 of slide valve 30, which opens jet 29^2 and stops conduit 43. The section of jet 29^2 has been chosen in such manner the total of the outputs of jets 29^1 and 29^2, feeding fuel to main jet 14 are, for a given pressure, lower than the value of the output through main jet 14, if the latter were fed directly from chamber 7. Push piece 49 is adapted to slide freely with respect to membrane 35 and it is urged toward partition 50 by an auxiliary spring 51 which bears against the bottom of a cup-shaped extension 52 of push piece 34.

When the suction existing in the intake conduit at the level of orifice 40 drops below a

predetermined value, spring 38 overcomes the tension of spring 51, push-piece 49 enters its housing, constituted by part 52, and membrane 35 keeps moving toward the left, driving together with it slide valve 30, which uncovers passage 12. In this day, the output of jet 14 is increased and the amount of fuel in the mixture is increased.

Another way of modifying the carburation curve consists in reducing, under certain conditions, the value of the suction exerted in chamber 7 and, consequently, the value of the injection pressure.

When throttle valve 2 is widely opened, the suction existing in box 25 and acting upon membrane 24 is insufficient for overcoming the action of the return spring of valve 23 and the latter closes the opening 22 of chamber 19. The suction existing in this chamber is therefore maximum, same as the injection pressure in chamber 7.

When, as a result of the partial closing of the throttle valve, the suction in the body 1 of the carburetter opposite the outlet of tube 26 reaches a given value, valve 23 starts opening, thus allowing air to enter through orifice 22, more and more as the value of the suction increases in the intake conduit. The shape of the curve corresponidng to this increase depends upon the shape of the axial section of valve 23 and the elasticity of its return spring. This inflow of air into chamber 19 decreases the suction existing in chamber 16, whereby the amount of fuel in the mixture fed to the engine is reduced.

I might also reduce the amount of fuel in the mixture, for any desired purpose, by connecting chambers 16 and 27 together through a by-pass 53 (Fig. 2) the section of which can be modified by obturating means actuated either manually or automatically. For instance, as shown by Fig. 2, said means consist of a needle valve 54 controlled by a barometric box or by a membrane 55 mounted on a chamber 56 which communicates, through a tube 57, with the carburetter body behind throttle valve 2.

In this case, the suction transmitted in chamber 27 through by-pass 53 exerts an action not only on membrane 17 but also on membrane 35 through orifice 42. This action serves to maintain the operation corresponding to power working conditions for higher suctions in the intake conduit of the engine.

I may also provide in chamber 27 a spring 58 fixed to a spindle 59 adapted to be turned through a lever 60 or the like. When this lever is displaced toward the right of Fig. 1, spring 58 comes into contact with membrane 17 and exerts thereon a pressure toward the left, which increases the injection pressure and therefore facilitates, for instance, the starting of the engine.

This lever 60 may be connected to the means for operating throttle valve 2 (Fig. 2) for instance through a rod 61 interposed between lever 60 and said means 3, and sliding in a sleeve 62 pivoted to lever 60. An abutment 63 carried by said rod is adapted to come into contact with said sleeve 62 when throttle valve 2 occupies a position close to its fully opened position and is nearing the position corresponding to an excess of power (more especially in the case of an airplane engine). In this way, I obtain the automatic displacement of lever 60 in one direction corresponding to spring 58 coming into contact with membrane 17 and pushing said membrane toward the left of Fig. 2 in order to increase the percentage of fuel in the mixture, which is generally necessary when an excess of power is to be obtained.

I may also, as shown by Fig. 2, adjoin to chamber 19 means for correcting the adjustment in accordance with the height, said means consisting for instance in an orifice 64 provided in a wall of said chamber and opening to the atmosphere or to the air intake of the carburetter. The section of this orifice can be modified by a valve 63 carried by a barometric box 66.

This correcting device is adjusted in such manner that, at the usual intake pressure (barometric pressure on the ground level or inlet pressure in the case of an engine fitted with a supercharger located before the injection carburetter) valve 65 closes orifice 64.

When, under the effect of an increase of height, the pressure acting on box 66 decreases, said box expands and permits an inflow of air into chamber 19. This inflow of air has for its effect to reduce the suction existing in chamber 19 and consequently to reduce the injection pressure.

If orifice 64 is made of suitably shaped section and valve 65 is of suitable profile, it is possible to maintain a desired composition of the mixture when the height varies.

This correction might also be effected, as shown by the dotted lines of Fig. 2, by means of a barometric box located opposite the free end of slide valve 30, i. e. the end which is normally acted upon by lever 32. The box is then so located that at the atmospheric pressure on the ground level (or at the usual inlet pressure) slide valve 30 can work over the whole of its stroke. On the contrary, at lower pressure, box 67 expands and acts as an abutment for said slide valve so as more and more to limit the displacement thereof in the direction corresponding to an increase of the percentage of fuel present.

According to a modification, the barometric box would be mounted in a chamber (not shown) connected through a conduit with the air intake of the carburetter if the latter were mounted behind a supercharging compressor.

In the examples shown by Figs. 1 and 2, the fuel is injected under pressure into the carburetter body and behind throttle valve 2 through venturi 5, in such manner that the jet or jets are not subjected to the suction existing in the intake conduit of the engine.

In some cases, it might be advantageous to subject the jet or jets to a portion of the suction existing in the body 1 of the carburetter, behind the throttle valve, by placing jet 14 to a relatively short distance from the inlet of Venturi tube 5.

Instead of injecting the fuel to a portion of body 1 located behind the throttle valve, I might also feed this fuel at a point before this throttle valve, for instance in inlet tube 4, jet 14 being or not subjected to the suction existing in said inlet tube.

Instead of controlling slide valve 30 through pneumatic means (membrane 35) I might use other means such for instance as a mechanical device including a rod and a lever, so as to produce the change of carburetting conditions by a modification of the position of said slide valve 30 for a given position of slide valve 2.

Whatever be the particular embodiment that is chosen, I obtain a carburetter which is well adapted to meet the requirements above set forth.

MARCEL LOUIS MENNESSON.

PUBLISHED

MAY 25, 1943.

BY A. P. C.

M. L. MENNESSON

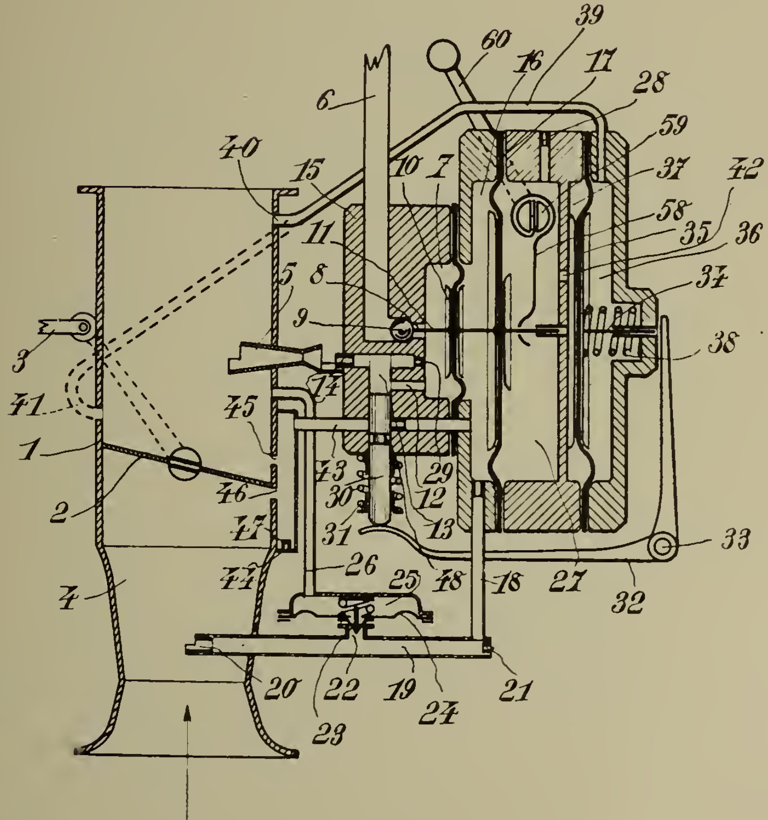
CARBURETTERS OF THE FUEL INJECTION TYPE

Filed May 5, 1941

Serial No. 391,968

2 Sheets-Sheet 1

Fig.1



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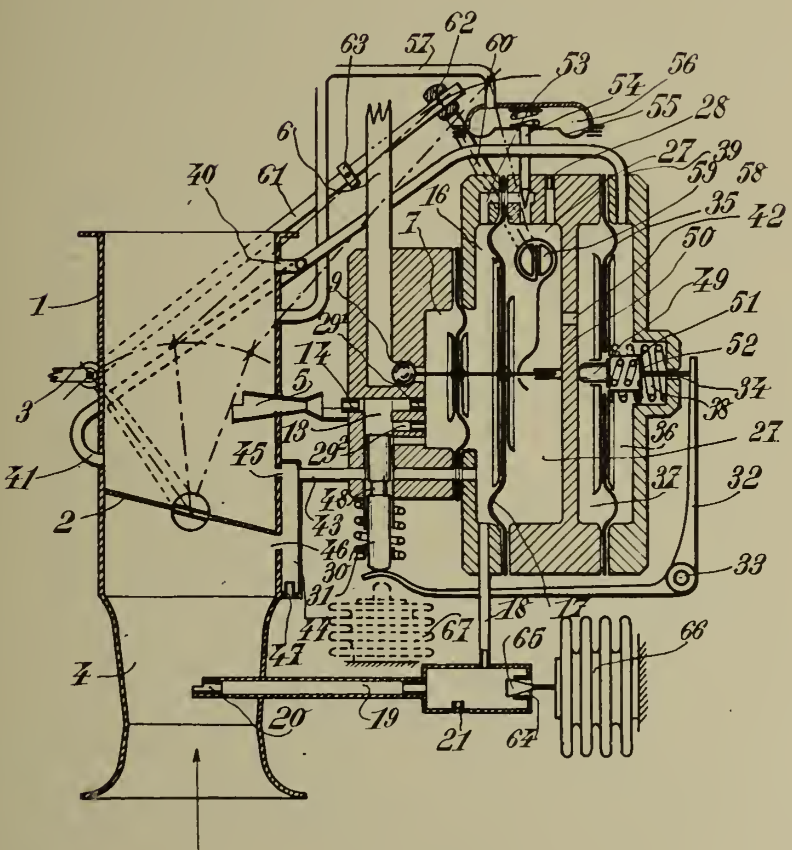
PUBLISHED | M. L. MENNESSON | Serial No.
MAY 25, 1943. | CARBURETTERS OF THE FUEL INJECTION TYPE | 391,968
BY A. P. C. | Filed May 5, 1941 | 2 Sheets-Sheet 2

Fig. 2



INVENTOR
MARCEL LOUIS MENNESSON,

BY Bailey, Stephens & Huettig
ATTORNEYS

ALIEN PROPERTY CUSTODIAN

HYDRAULIC SHOCK ABSORBER AND LANDING GEAR EMBODYING SAME

Charles Raymond Waseige, Rueil, France; vested in the Alien Property Custodian

Application filed May 6, 1941

This invention relates to the hydraulic shock absorbers, more particularly adapted to be used in landing gears for aircraft, of the kind comprising two bodies telescopically sliding relatively to each other, the relative displacement of said bodies being effected in the one direction by the action of an external force against a yielding medium and causing a liquid—usually oil—to be forcibly driven through a passage, the free section of which is relatively large, and in the other direction by the action of the expansion of said medium which has been energised, the speed of this expansion being limited by the throttling of the liquid flow.

The aforesaid yielding medium is usually compressed air contained in a chamber the volume of which varies in response to the relative position of said bodies, the shock absorbers being then called hydro-pneumatic shock absorbers.

The shock absorbers adapted to be used on aircraft machines are required not only to be strong enough to resist without risk of failure to all the strains likely to be encountered in use, but also to be of light weight, as compact as possible and able to be tilted in every direction without impairing the operation thereof. The latter qualities are particularly useful in case the shock absorber is to be made a part of a retractable landing gear for the housing of which a very limited space only is available in the airplane structure.

One essential object of this invention is to provide a new and improved construction of shock absorber fully answering to the special requirements and conditions of use on aircraft and remarkable namely in that the space into which the same can be lodged, at rest, is very small relatively to its power.

In view of this main object, the present invention consists in a hydraulic shock absorber of the aforesaid kind in which the relative displacement of the two bodies telescopically sliding relatively to each other in the direction of the extension of the assembly corresponds to the energization course of the yielding medium, while the relative displacement of said bodies in the direction of the contraction of the assembly corresponds to the de-energization course, the speed of which is braked by throttling the flow of liquid.

This results in a construction of shock absorber the length of which, in the position of rest, is reduced to a minimum as compared with the usual constructions hitherto used.

In accordance to a preferred embodiment of this shock absorber, the same comprises two tubular bodies one of which is provided with a bottom member and serves as a cylinder and the other of which, having a smaller diameter than the first one and sliding therein, is closed at its end inserted in said first one by a one-way valve adapted to be pressed upon its seat by the liquid returning from the first body into the second as the shock absorber is contracting, said valve being adapted then to present a throttled passage for the flow of liquid.

The second tubular body may conveniently serve as a cylinder for a sealing piston engaging with the walls thereof and normally contacting with the upper surface of the liquid therein, said piston having a passage normally closed by a valve which is adapted to open—preferably automatically—as said piston rises in said body above a predetermined level, thus allowing the shock absorber to be drained when filling same.

The oil leakages are thus avoided whatever be the angle of inclination of the shock absorber.

When using compressed gas as the aforesaid yielding medium—and this is an advantageous feature of the invention—the second tubular body carries at its end inserted in the first body a sealing device acting as a piston, while another sealing device or a stuffing box carried by said first body clamps the second body where it emerges from said first body so as to form between the two bodies a sealed annular chamber of substantial space into which compressed gas is introduced and the volume of which varies in proportion but in a reverse ratio with the length of the shock absorber.

This chamber may easily be given a sufficient inner space to allow of dispensing with any additional reservoir requiring delicate piping and couplings.

The present invention has also for its object a landing gear embodying a shock absorber the expansion course of which corresponds to its energization and which advantageously though not necessarily comprises the aforesaid features, and more particularly a landing gear of the kind described in U. S. Patent Application No. 226,569 filed on the 24th of August, 1938, in which said shock absorber acts as an accumulating device and is carried by the foldable elements of the gear so as to accumulate energy during the lifting of the gear and to restore this energy during the descent of the gear controlled thereby at a speed limited thereby.

In a preferred embodiment, in which said landing gear consists of a supporting frame hinged to the structure of the aircraft and carry-

ing a wheel or the like and of a folding strut holding said frame in low position, the shock absorber of the aforesaid kind is coupled between the upper part of said frame and the lower part of said strut without requiring the provision of a hinged system therebetween.

Other features and advantages of this invention will be apparent from the following description and the accompanying drawing, given solely as an example and in which:

Fig. 1 is a sectional elevation of a shock absorber, the middle part being broken away;

Fig. 2 shows diagrammatically the assembly at a smaller scale with the elements in another position;

Fig. 3 shows a landing gear according to the invention in its low position and, in chain dotted lines, part of its elements in an intermediate position;

Fig. 4 is a corresponding front view.

Referring to Fig. 1, the shock absorber comprises two cylindrical bodies or solids of revolution 1 and 2, the middle part of which is broken away in order to show more clearly the remaining parts, though it obviously extends continuously between the upper and lower parts as shown in Fig. 2.

These two cylindrical or tubular bodies are telescopically mounted relatively to each other. The outer body or tube 1, i. e. that of larger diameter, carries at its end a bottom member 3 underneath which said tube is integrally connected with fastening devices by means of which it may be operated and secured. Other devices adapted to fasten the shock absorber are integral with a jointing member 5 connected by a screw-thread with the upper end of body 2.

The bottom member 3 is provided with a passage 6 communicating with the outside through a non-return valve member 7 co-acting with a seat presented by a pipe union or coupling 8 normally closed by a cap 10. The valve member 7, adapted to be used for filling the shock absorber with liquid, carries a protruding stem 12 by means of which said member may be opened from the outside. A similar valve 16, mounted by means of a coupling 17 on the outer wall of tube 1, permits of introducing compressed gas into the latter, said valve being protected by a cap 20. A pressure gauge 21 is connected with coupling 17. The tube 2 acts as a piston inside the outer tube 1 and, for this purpose, it carries on the one hand at its lower end a series of sealing gaskets 25 engaging with the inner wall of said outer tube 1; on the other hand, the part of said inner tube 2 that emerges from said outer tube 1 is clamped by a surrounding stuffing-box 27 mounted in the latter at the upper end thereof. Said stuffing-box 27 is covered by a layer of grease 30 protected by a washer 31 which is held in position by a flanged collar having a threaded engagement with the upper end of body 1.

A plug 35 is screwed to the lower end of the inner tubular body 2 and is provided with a central opening 36 the mouth of which is formed as a seat for a perforated plate-valve 37. In front of said seat, the plug 35 carries a stop flange 38 adapted to limit the downward or opening movement of valve 37.

At its upper end the inner tube 2 communicates with the open air by means of ports 40 provided in its side wall and registering with openings 41 provided in the jointing member 5. The latter serves as a stop for a piston 45 adapted to slide freely in the inner tube 2 and to seal the latter by means of a gasket 46 carried by said piston and engaging with the wall of said tube 2. Inside said piston 45 is provided a recess 48 permanently connected with the inner portion of tube 2 comprised between said piston and the plug 35. An axial bore 52 connects said recess 48 with the upper portion of the internal space of tube 2. Said bore 52 is enlarged at its lower part so as to form the seat of a valve 55 having a rear stem projecting through the bore. A spring inserted in the recess 48 urges said valve 55 against its seat. The whole device is so arranged that the stem 56 engages with the jointing member 5 for opening the valve 55 when the piston 45 abuts against said jointing member at the end of its course.

Previously to the use of this shock absorber, the chamber formed between the sealing gaskets 25 and the stuffing box 27 is filled with compressed air through the valve 16 which causes the gaskets, together with the inner tube 2, to be yieldingly urged towards the bottom of Fig. 1, the position of rest of the shock absorber corresponding to the abutment of the plug 35 against the bottom member 3. On the other hand, oil is introduced into the shock absorber through the coupling 8 so as to fill the internal space of tube 2. During the filling operation, the piston 45 is lifted in accordance with the rise of the liquid. When the piston reaches the end of its course, as shown in Fig. 1, the valve 55 opens, thus relieving any air that may overlie the layer of liquid. The appearance of leakage oil issuing through the holes 40 indicates that the filling operation is completed.

During the use, the extension course corresponds to the compression of the air cushion and to the free flow of liquid through the opening 36 at the lower part of tube 2. As soon as this course is completed, the compressed air tends to drive back the tube 2 downwardly and to return the liquid into said tube. During this movement (Fig. 2), the valve 37 closes itself and the liquid can only flow through the hole or holes provided at the center of said valve, which throttles the flow and causes a braking action reducing the speed of expansion.

As shown in Fig. 2, the piston 45 follows the variations of the liquid level, isolates the liquid from the surrounding air and avoids any leakage, particularly at inclined positions of the shock absorber.

Figs. 3 and 4 show a landing gear in which the new shock absorber acts as an accumulator during the descent.

This landing gear comprises substantially one or two landing gear shock absorbers 100, of the usual kind, to the end of which a landing wheel or the like 101 is secured. This shock absorber is supported at its upper end by a clamping collar 103 hinged to the aircraft structure through the medium of a shaft 104. Each landing gear shock absorber 100 is held by a folding strut consisting of two links 106 and 107 hingedly jointed together at 109 and one of which, 106, is pivoted to the aircraft structure, while the other, 107, is pivoted to a collar 111 clamping the shock absorber 100 at its lower end.

A shock absorber of the above described type 120 is directly coupled between a pivot 121 carried by the collar 103 and a pivot 122 carried by the link 107. As viewed in Fig. 4, this shock absorber 120 is entirely hidden at the front by the

corresponding shock absorber **100** and thus takes no space in the transverse direction.

It will be assumed that the landing gear is of the driving hinge connection kind and comprises a lifting motor assembly contained in a casing **125** arranged at the hinge connection **109** of the links **106** and **107**.

This landing gear is completed by low and high position locking devices, respectively, consisting of fingers **120** and **130** co-acting with hooking systems **131** and **132**. A landing gear of this kind is described in U. S. Patent Application No. 226,569 filed on the 24th of August, 1938 under the name of the applicant.

The whole arrangement operates as follows:

During the lifting course effected in response to the operation of the relative rotation of the links **106** and **107** by the driving mechanism contained in the casing **125**, the link **107** swings in the direction of the arrow *f* relatively to the shock absorber **100**. This causes the extension of the shock absorber **120**, i. e. a compression of the air or the like contained therein and an accumulation of power. The linkage is so arranged that at the end of the lifting course, as shown by chain dotted lines, the pivot **121** is located above the shaft **104**, so that the turning couple imparted to the landing gear by the shock absorber **120** is slightly negative though remaining smaller than that produced by the weight of the landing gear, so as to relieve the locking device **130**—**132** when the landing gear is lifted.

For lowering the gear, the finger **130** is disengaged, which causes the gear to move down under the conjoint action of its own weight and of the force imparted to it by the shock absorber jack **120**, which at the same time acts as a brake for limiting the speed of this lowering course.

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Fig. 3.

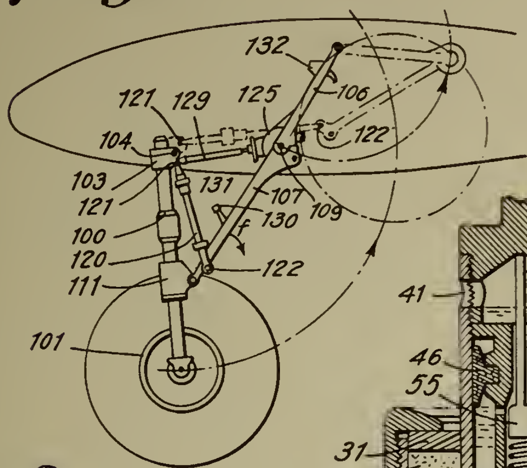


Fig. 4.

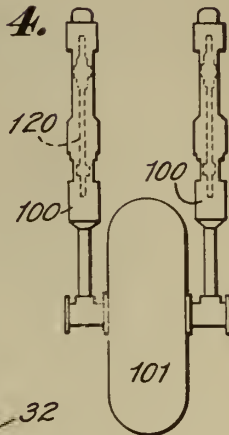


Fig. 1.

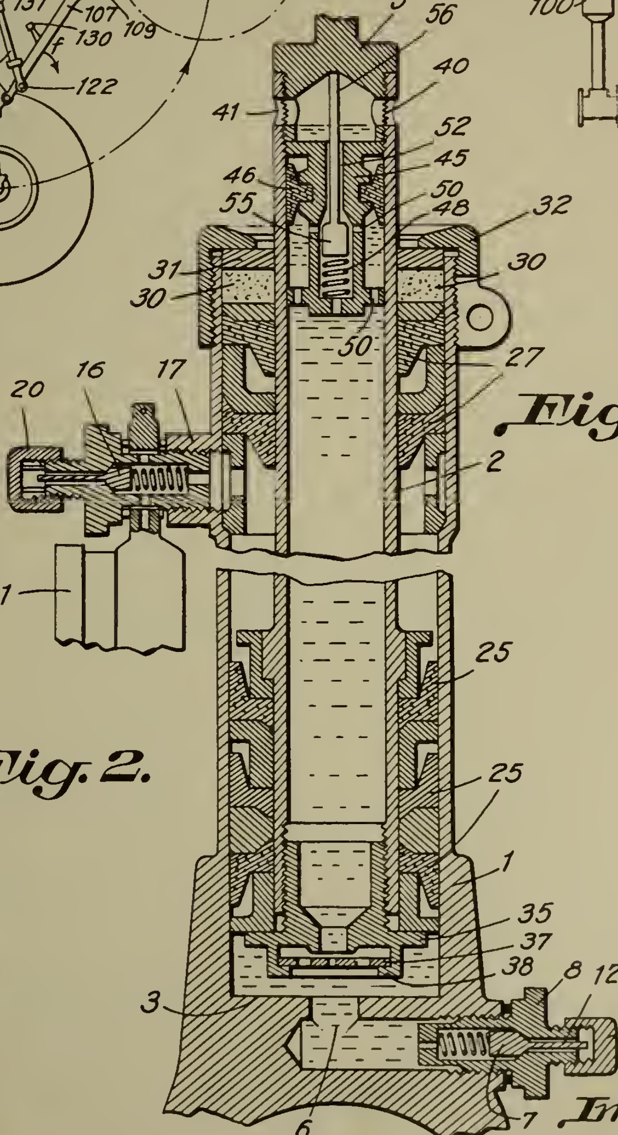
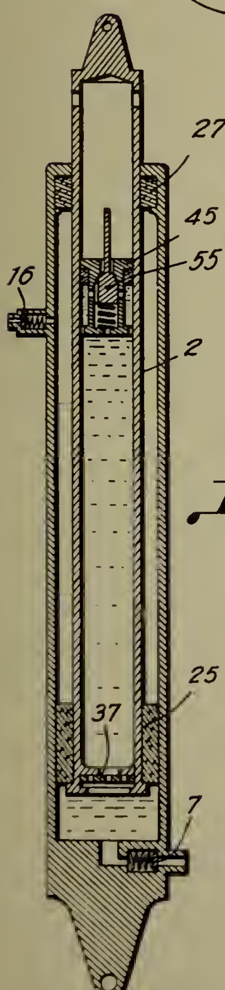


Fig. 2.



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ALIEN PROPERTY CUSTODIAN

PROCESS OF PRODUCING AQUEOUS EMULSIONS, ESPECIALLY SUITABLE FOR TREATING TEXTILES, PAPER AND LEATHER

Adalbert Müller, Augsburg, Germany; vested in the Alien Property Custodian

No Drawing. Application filed May 8, 1941

The patent (application No. 327,344) contains inter alia the description of the production of aqueous emulsions of waxes, fats, oils, and other fatty substances, which, if they have a low acid value, are thoroughly mixed with aqueous solutions of basic salts of aluminium or tetravalent metals. It is not necessary to add protective colloids.

The subject of the present process is the emulsification of waxes derived from high-molecular fatty acids with about 22 and more carbon atoms, especially with about 26 to 30 carbon atoms, principally such as the lignite waxes. In this case, the emulsification will be possible even if the waxes have a higher acid value, for example 50 to 70. Such waxes may, therefore, also be emulsified in the simple and cheap manner described in the main patent.

The emulsification may also be effected with mixtures of salts of aluminium and tetravalent metals, and the waxes may be diluted with organic solvents. Furthermore, hydrocarbons, such as paraffin, may also be used in the emulsification. Among the salts of tetravalent metals, principally those of zirconium, thorium, titanium, and uranium, are suitable for the purpose. As organic solvents there are used especially chlorinated hydrocarbons.

Example No. 1.—19 kgs. of a basic solution of aluminium formate, containing 16% of aluminium oxide and 13% of formic acid, are placed in a turbo-mixer and are heated to 60° C. Then there is added a solution, heated to 70° C., of 2.5 kgs. of a lignite wax (acid value 85, saponification value 90, melting point 75° C.) in 1 to 2 kgs. of perchlor-ethylene under constant stirring. After a short time, the resulting emulsion will get thick, whereupon 20 litres of warm water of 40° C. are slowly added, and then the substance is stirred cold. The emulsion is stable and may readily be diluted with water.

Example No. 2.—1 kg. of crystallized zirconium oxychloride and 0.4 kg. of crystallized sodium acetate are dissolved in 3 litres of water while being heated, and then the solution heated to 60° C. is mixed in a turbo-mixer with 5 kgs. of a mineral wax with an acid value of 60. There results an emulsion which may be diluted with water.

Example No. 3.—An emulsion will also be formed by melting 1.5 kgs. of a mixture of about equal parts of paraffin and ceresin with 1 kg. of a high molecular wax with an acid value of 70, and by pressing it, together with 5 kgs. of a warm solution of aluminium acetate (6% aluminium oxide), through a homogenizing nozzle. After some water has been added, the resulting emulsion is stirred cold. It may be diluted as desired, and if it forms cream in the diluted state, this may be easily removed by stirring.

ADALBERT MÜLLER.

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ALIEN PROPERTY CUSTODIAN

VALVE SYSTEMS

Jean Louis Gratzmüller, Paris, France; vested in the Alien Property Custodian

Application filed May 8, 1941

The present invention relates to seats for valves made of a plastic material or at least including a portion of a plastic material coming in contact with the seat and adapted to receive, on its free side, the action of a fluid pressure.

The invention is more especially, although not exclusively concerned with the valve seats to be provided in devices, such as oleo-pneumatic accumulators of energy, oleo-pneumatic shock-absorbers, etc., which include a part such as a bag the bottom portion of which, acting as a valve, comes to bear against the bottom of a container in which the seat in question is provided.

In devices of this kind, seats for the portion of the bag acting as a valve were constituted merely by the bottom wall of the container (for instance made of metal) provided with holes of a diameter sufficiently small for permitting the stopping thereof by the application thereon of the bottom portion of the bag, without the material which forms the bag or the bottom portion thereof being able, at least theoretically, to penetrate into these holes, which would injure the bag and cause it to burst.

However, in devices of this kind, difficulties of operation have often been experienced in view of the fact that the plastic matter of which the bag (or at least the bottom portion thereof) is made has a tendency, under the effect of the high pressures existing in this bag, and despite all the precautions that may be taken for the manufacture of said bag, to penetrate into the holes of the container and to be cut by the edges of said holes.

The chief object of the present invention is to provide seats for the valves of the type above referred to which are better adapted to meet the requirements of practice and in particular which avoid the very serious drawback just above mentioned.

With this object in view, according to a feature of the present invention, seats for valves of the type above referred to are constituted by holes of a particular shape capable of cooperating in a satisfactory manner with the plastic valve element, this particular shape being that of a frustum of a cone the inclined wall of which is joined by curved surfaces without sharp edges to the bottom of the container in which the valve seat is formed. As any sharp is avoided in the portion of the container wall adapted to cooperate with the bag or other plastic valve element, there is no danger of said bag being cut.

Thus according to the invention, each hole is given the shape of a conical pit prolonged eventually by a cylindrical hole, the plastic material of which the valve is made penetrating into the conical portion of the hole and settling therein without coming into contact with any projection or sharp edge that might injure and finally cut it.

With this arrangement, the holes, instead of having a cross section as small as possible, have a cross section, in the plane of the bottom surface of the container, which is relatively great, this cross section decreasing gradually until it reaches a minimum value which then remains uniform and corresponds to the cylindrical portion above referred to.

Contrary to what might be supposed, this increase of the area of the cross section at the top part of the hole is favorable to a good preservation of the matter of which the valve element is made and also to fluid tightness of the valve system.

Another object of the present invention is to provide an elastic or plastic valve well adapted to cooperate with valve seats as above described.

With this object in view, and according to a second feature of the invention, the valve element, constituted for instance by the bottom portion of a bag, is made of relatively important thickness, in view of the cross section of the holes, so as to form a mass adapted to cram or pack in the frusto-conical portion of the orifices.

According to still another feature of the invention, the bottom portion of the bag, reinforced in the usual manner by the addition of layers of fabric, by calendering, etc., is provided, on its outer face, intended to cooperate with the holes in the container, with a layer of relatively soft plastic material, which facilitates the packing of the bag in the orifices and prevents the resistant portion of said bag bottom from undergoing important deformation in these orifices.

Another object of the present invention is to provide a method of making holes of the desired shape as above mentioned in the bottom walls of the containers, which are generally made of hard metal.

As a matter of fact, it is difficult to form in such metal walls holes of small section having rounded edges and a longitudinal section of the desired shape.

Now, I have found, from practical experiments, that it suffices, in order to avoid the drawbacks above mentioned, to provide a seat having no cutting or sharp edge in the part thereof in which the plastic material of the valve element is under tension even if, along portions of the

plastic element subjected merely to compression stresses, the seat includes projections.

This discovery is extremely important for practical purposes because if cylindrical holes are bored in a metallic wall and if these holes are subsequently punched in the usual manner so as to give a rounded shape to the edges, the metal driven toward the inside forms projections on the inner walls of the holes.

These projections are thus located in a particularly dangerous region.

In order to avoid this drawback, according to the present invention, after the holes have been drilled, the punching operation is effected by means of a punching tool the tail of which, intended to engage in the hole, is of cylindrical shape and of a diameter equal to the inner diameter of the hole in question.

It follows that the metal, instead of being driven toward the inside of the hole is pushed upwardly and outwardly and forms a kind of ridge around the mouth of the hole. Contrary to what might be supposed, this ridge involves no danger for the bag or other plastic valve element, because, in this region, the plastic material is in compression.

Other features of the present invention will result from the following detailed description of some specific embodiments thereof.

Preferred embodiments of the present invention will be hereinafter described, with reference to the accompanying drawings, given merely by way of example, and in which:

Fig. 1 is a diagrammatic cross section of a valve system, showing the ideal shape to be given to the orifice according to the invention and illustrating in what manner the plastic matter behaves in this orifice.

Fig. 2 is a diagrammatic section of a container wall with a cylindrical hole drilled therein;

Fig. 3 is a similar view showing the orifice after it has been shaped according to the present invention.

Fig. 4 is a cross sectional view of a punching tool for the obtainment of orifices of the kind of that shown by Fig. 3.

Referring to the drawings, I have shown on Fig. 1 an orifice the shape of which has, on the side corresponding to the inside of the container, a frusto-conical portion 1, joined to the bottom 2 of the container in question by a rounded portion 3. This frusto-conical portion 1 is prolonged by a cylindrical portion 4, without any sharp ridge or projection on the inner wall of the hole. The plastic matter which constitutes the valve element, for instance the bottom portion of the bag, is shown at 5.

As shown by the drawing, this matter, under the effect of the pressure to which is subjected, penetrates into the mouth of the hole and is wedged or packed therein. In the top portion of the hole, this matter is under tension and, moving downwardly, a point is reached where a state of equilibrium exists owing to the reaction of the wall of the hole (arrows 6) having the same value as the pressure, designated by arrow 7. From this point downwardly, the plastic matter of the bag is merely compressed and it has no tendency to be injured.

As above explained, I preferably provide, along the under surface of the valve element, for instance of the bag, a layer of soft plastic matter of a certain thickness so as to facilitate the packing of the mouth of the orifice and to avoid that the resistant portion of the valve should undergo unnecessary deformations.

In Fig. 1, the hard and resistant portion of the valve element is represented at 8 and the softer portion at 5.

However, it should be well understood that this construction of the valve element constitutes only a preferred embodiment and that the invention is in no way limited thereto.

As above explained, it is often difficult, for practical purposes, to make holes of the shape shown by Fig. 1, in view of the small section of said holes and of the hardness of the metal of which is made the bottom of the tank or other container in which said holes are to be made.

According to a feature of the present invention, I proceed in the following manner:

First, I make cylindrical holes, such for instance as shown by Fig. 2. In this drawing, reference numeral 9 designates the bottom of the container in which the orifices are made, and 10 designates the orifices or holes themselves. After this first operation, the orifices have a cylindrical shape.

The second step of the method consists in punching these holes by means of a punching tool the general shape of which is for instance that shown by Fig. 4. The tool shown on this Fig. includes a cylindrical portion 11, of a diameter equal to that of the hole to be made and a portion 12 the inner surface of which is joined to portion 11 by a rounded surface.

After the punching operation effected by means of this punching tool, the holes have the general shape shown by Fig. 3.

As shown by this view, each hole includes a cylindrical portion 4, a frusto-conical portion 1, corresponding to the theoretical shape illustrated by Fig. 1, and a ridge 13, constituted by a raised portion of the container bottom, this ridge being formed by the matter pushed upwardly and outwardly by the punching tool.

As above explained, the presence of this ridge involves no danger for the valve element because, in the region in which it is located, the plastic matter is only in compression.

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Fig.1

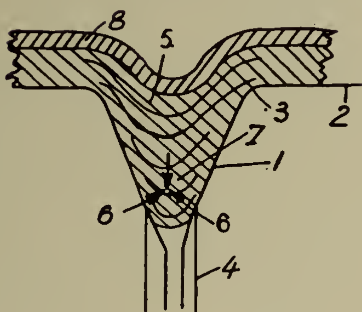


Fig.2

Fig.3

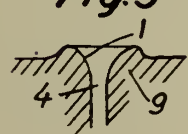
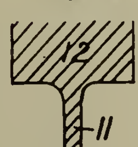


Fig.4



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ALIEN PROPERTY CUSTODIAN

METHOD AND APPARATUS FOR COUNTING BLOOD CORPUSCLES

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Application filed May 12, 1941

This invention relates to the counting of blood corpuscles and comprehends within its scope an improved process and apparatus for counting either red or white blood corpuscles present in a sample of blood. More particularly the invention comprises a method and apparatus for causing blood corpuscles to pass successively one after another past a given point at which they may be counted.

The standard practice of the art for counting blood corpuscles has involved the dilution of blood with a suitable diluting liquid in an appropriate proportion, and thereafter placing a drop of the diluted blood in a counting chamber of known height having engraved in its bottom surface a network of unit areas of known size. The number of blood corpuscles on one or more of the unit areas is then counted by an operator with the aid of a microscope. From the known dimensions of the apparatus the number of corpuscles per cubic mm. is calculated. Variations have been made in this procedure, but in general all methods, so far as I am aware, involve the counting by an operator of the number of corpuscles in a unit area. Such methods involve an error of ±5%.

In accordance with my invention a sample of blood is first diluted in a known proportion with a suitable dilution liquid, and thereafter the blood corpuscles while suspended in the dilution liquid are caused to pass successively one after another through a confined space and are counted while passing through this confined space. The blood corpuscles may be caused to move through the confined space and past the counting point by applying pressure to the liquid prior to its passing therethrough, or by the application of a reduced pressure at the outlet end of the confined space. The just recited method may be advantageously carried out by the use of the apparatus of the invention, which includes a vessel for diluted blood and connected therewith a channel member so dimensioned in cross section as to cause the blood corpuscles which are to be counted to pass therethrough and to pass the counting point in the channel individually and successively. At least a part of the oppositely disposed walls of the channel member must be of transparent material in order to permit the counting of the corpuscles passing successively through the channel. In practice it has been found advantageous to make the entire apparatus of a transparent material such as glass. The counting is with particular advantage accomplished by a counting device dependent for operation on the photoelectric principle either with or without a microscope.

The process of the invention provides a simpler, more rapid and more precise method of counting blood corpuscles than those heretofore employed. The apparatus is not complicated, and, if a counting device embodying a photoelectric cell in conjunction with a recording and counting arrangement is employed, the operation of the apparatus becomes automatic with an attendant increase in precision. In fact if the proper manipulative precautions are taken and the apparatus is properly proportioned, a precision approximating 100% may be attained either by the use of automatic means or by counting manually with the aid of a microscope. In actual practice a precision approximating 100% is seldom required, so that the dimensions of the apparatus and the manipulation thereof may be less carefully controlled, and the result will still be more exact than that obtained by previously known methods and apparatus.

In an apparatus designed to secure the greatest possible precision, the channel member is dimensioned on the basis of the size and shape of the blood corpuscles to be counted. Red blood corpuscles, which are plastic, are when stationary biconcave discs with a normal average diameter of 7.5 μ and a thickness of 2 to 3 μ. In blood diseases the diameter may vary from 4 to 13 μ and the thickness may vary up to about 5 μ. The white blood corpuscles are approximately spherical and have a diameter ranging from about 6 to 22 μ. All red blood corpuscles, even the largest, may because of their plasticity pass through a channel having a height of about 5 μ and a width of about 10 μ. The smallest of the red blood corpuscles may be caused to pass through such a channel individually by increasing the dilution of the blood sample. It has been shown by tests, however, that the red corpuscles in a suitably diluted blood sample will pass successively one after another through a channel considerably larger than the one just described. For example, a tube having a diameter of 20 μ may be successfully employed as the channel member. Standard calibrated tubes of this dimension are readily available at low cost, thus making possible in practice the use of a new tube for each test. Ordinarily in a typical sample of blood there is only about one white corpuscle to every thousand red ones, and even in extreme cases the proportion is less than ten white blood corpuscles for each thousand reds. Because of this fact a count of the

usually desired precision will not be harmed by one or two white blood corpuscles passing through the channel, when a channel of sufficiently large dimensions is being used, and being erroneously counted together with the red corpuscles. In general the counting of approximately five hundred red corpuscles will provide a result of sufficient accuracy and the number of white corpuscles involved is thus negligible.

Best results are obtained by preventing the inlet of the counting passage from being clogged by the larger white corpuscles. This may be accomplished in several ways, among which may be mentioned the following. The diluted blood is first passed through a channel having both a width and height of at least 24 μ, and thereafter through a channel of the same width but having a height of about 5 μ. By this expedient the one or more white corpuscles occurring in an average sample being counted will be stopped at the entrance to the shallow channel, while a sufficient number of red corpuscles to give a precise count will continue through the shallow channel. The apparatus may also be made in such a way that the white corpuscles may actually be separated from the red, and if desired be counted separately. To accomplish this an inclined wall is placed at the point at which a large dimensioned channel narrows to connect with a smaller dimensioned channel. The large white corpuscles are impelled by the inclined wall laterally into a pocket or into a channel of appropriate size to permit their successive passage therethrough, it thus being possible to count the white corpuscles passing through the said channel. The red corpuscles will tend to be oriented with their flat sides facing the bottom of the channel and will continue forwardly through the narrow channel, which is positioned below the entrance to the referred to pocket or larger channel.

Appropriate means may be provided at either the inlet or outlet end of the channel for causing the diluted blood sample to pass through the counting channel at a desired rate. For example, means may be provided for increasing the pressure in a vessel connected with the inlet end of the channel. Such means may operate by increasing the air pressure over the diluted blood sample in the vessel. If the vessel is closed, the increased pressure may be produced by means of the application of heat. Alternatively a reduced pressure may be supplied in the outlet end of the channel or in a vessel connected thereto. In a particularly effective and simple modification of the apparatus of the invention, the channel member is closed at one end by being sealed into a bulb member. If the opposite end of the channel is immersed in a diluted sample of blood, the blood will rise in the channel member due to capillary action, but not longer than to the entrance of the bulb. This action may be expediated by preheating the bulb and letting it cool while the channel is being filled. The length of the channel will then contain a predetermined definite quantity of blood. If now heat is applied to the bulb, the blood sample will be forced outwards through the counting channel, and the blood corpuscles may be counted during their outward passage, or the counting operation may take place while the blood sample is filling the channel.

In order to explain in greater detail appropriate apparatus for carrying out certain embodiments of my invention, reference will be had to the accompanying drawings in which:

Fig. 1 includes a diagrammatic prespective view of an apparatus having a counting channel connected at each end to vessels for the diluted blood, and a diagrammatic plan view of a photoelectric counting means associated with the counting channel.

Fig. 2 is an axial section of an alternative structure in which the counting channel member is sealed to a bulb member.

Fig. 3 is a diagrammatic perspective view of an apparatus capable of separating red and white blood corpuscles and counting them separately.

Fig. 4 is a top plan view of the device shown in Fig. 3.

In accordance with one embodiment of my invention illustrated in Fig. 1, the lower end of a vessel 1 is connected to a channel 2 which is a narrowing passage, either progressively as illustrated or in a stepwise decreasing cross section. Channel 2 is integrally connected with a counting channel member 3 having a width A and a height B, the said dimensions in at least a portion of the length of channel 3 being such that the cross section of the interior passage will permit the blood corpuscles which are to be counted to pass individually and successively through the passage. As here illustrated the dimensions of the channel member 3 are substantially uniform throughout its length. As previously indicated the dimensions A and B may with advantage be made to equal approximately 10 μ and 5 μ respectively in an apparatus in which the highest precision in counting the red corpuscles is desired, but the member 3 may also be of larger dimension, such as for example a tube having a diameter of 20 μ. The counting channel 3 opens into and is integrally connected with a channel member 5, which increases in cross sectional dimension and provides a connection to a second vessel 6. In the application of the process in such an apparatus, a diluting liquid is with advantage added to container 1 in sufficient quantity so that it passes through and fills the three channel members and vessel 6 to a height equivalent to that in vessel 1. A measured quantity of blood is then introduced into the liquid in container 1 and is caused to pass through the channel together with a dilution liquid, for example, by the application of air pressure in container 1 or by the application of reduced pressure in container 6. The channel member 3 is made of a transparent material, at least in its central section. Opposed to this transparent section one may employ a microscope and count the blood corpuscles passing beneath the field. The microscope may be replaced by a source of light 4 which transmits light through the counting channel 3 against a light sensitive surface 7, for example, a selenium plate. The light sensitive member 7 is connected in an electrical circuit comprising a source of electrical current 8, an amplifier 9 and a counting apparatus 10. Such an arrangement counts the number of corpuscles passing through the channel by virtue of the interruption of current flow through the circuit, and automatically records the number of interruptions in the counting mechanism. A lens may with advantage be placed between the counting channel and the light sensitive surface, in which case and also in the case where a microscope is employed, it is advisable to surround the counting channel with an immersion oil in order to reduce the refraction of the light rays.

In an apparatus such as that diagrammatically represented in Fig. 2, the channel member **3** is closed at one end by being sealed into a bulb **11**, which may be warmed by a source of heat **12** such as the bank of electric bulbs as illustrated. As previously described a device of this sort is operated by immersing the end of the channel **3** in a sample of blood **17**, whereby the blood will rise in the channel **3** due to capillary action and possibly also by the aid of the cooling of the bulb, if this is preheated. The corpuscles may be counted with the aid of a microscope as they pass through into the bulb, or by means of a photoelectric cell associated with a counting mechanism as illustrated in Fig. 1. Alternatively the diluted blood sample may be permitted to pass into the channel and then be expelled therefrom by means of heating the bulb, the counting being done as the liquid passes outwardly through channel **3**.

In the case of special examinations it may be desirable to separate the white corpuscles from the red in order to secure a very precise count or in order to count both types of corpuscle. A device such as is illustrated in Figs. 3 and 4 provides a satisfactory means for accomplishing this in accordance with my invention. As here illustrated a container **1'** is connected to an inclined progressively narrowing passage **2'** which is integrally connected about its perimeter at **13** with a narrowed channel member **3**a which is also inclined but connects with a counting channel member **3'**. From the inclined upper wall of passage **2'** adjacent the point at which the passage connects with the shallow inclined extension **3**a, there emerges a passage **14**, the axis of which is disposed at an oblique angle to the axis of the counting channel **3'**. This second passage may be extended to comprise an additional counting channel **15** of larger dimension and suitable for the free passage of white corpuscles, and may for convenience in counting be bent to run in a direction parallel to channel **3'** as illustrated. A counting arrangement similar to that illustrated in Fig. 1 may be disposed below the transparent walls of the channel and a source of light **4'** for directing light rays through the red corpuscle channel to impinge on a photosensitive surface **7'**. This photosensitive surface is connected in a counter-circuit of a type shown in Fig. 1. An additional source of light **4**a, directed through the channel **15** to a photosensitive surface **7**a, which in turn is in circuit with a counting device, is incorporated for the purpose of counting the white corpuscles passing through channel **15**. In an apparatus of this type the white corpuscles will be diverted by the inclined wall and the edge **16** of the two openings into the channel **14**, which in most cases should have a cross sectional dimension of not less than about 24μ. The narrower channel **3'** may have the same width as channel **14**, but should be substantially less in height, for example about 5μ.

In accordance with a further embodiment of my invention, blood corpuscles may be precisely counted by means of apparatus such as is disclosed in Figs. 1 and 2 under conditions such that the counting mechanism is sensitive to only the form of corpuscle to be counted. In such a method of operation a channel member having a diameter at least as large as the largest white corpuscle is employed. The red corpuscles are made colorless, for example by means of acetic acid, while the visibility of the white corpuscles is increased by the application of an appropriate dye. Under such conditions only the colored white corpuscles will register in the counting mechanism.

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METHOD AND APPARATUS FOR COUNTING BLOOD CORPUSCLES

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2 Sheets-Sheet 1

Fig. 1,

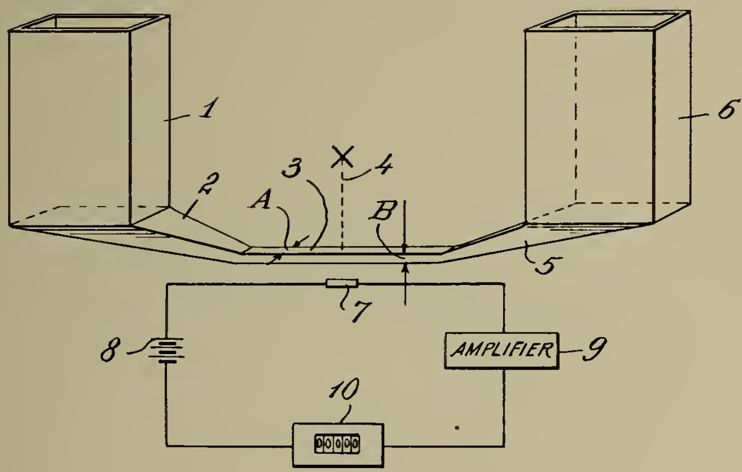

Fig. 2,

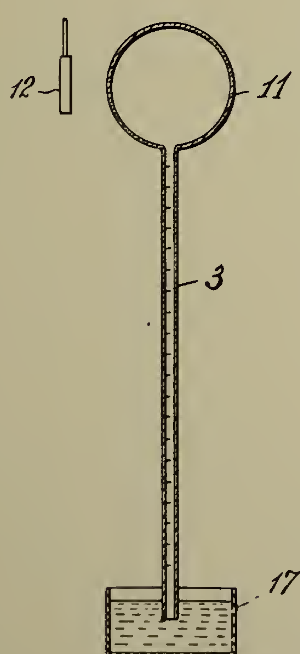

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Fig. 3,

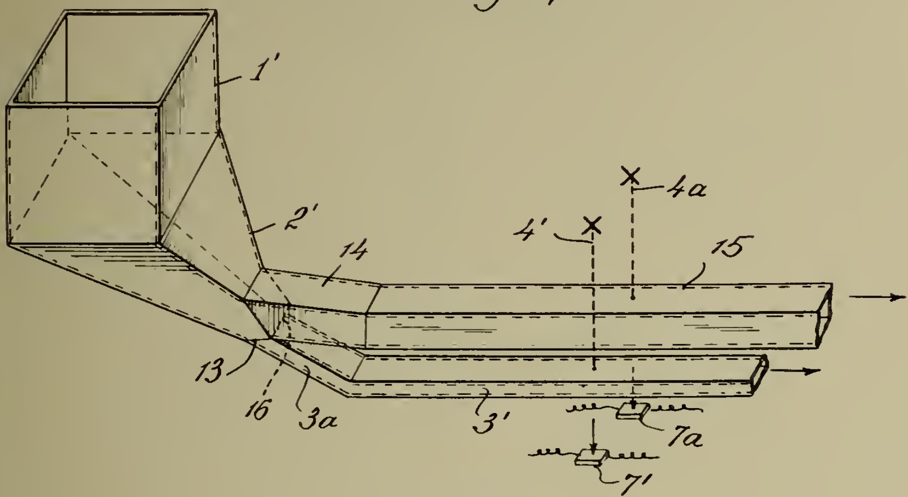
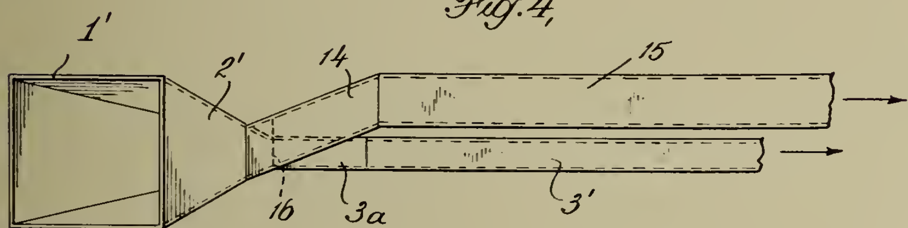


Fig. 4,



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ALIEN PROPERTY CUSTODIAN

ELECTRON TUBE DEVICE FOR ULTRA SHORT WAVES

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Application filed May 13, 1941

The invention relates to electron tube devices for generating, amplifying or receiving ultra short waves particularly of a wave length of less than 1 metre. Especially the invention relates to tubes comprising a hollow space constructed of metallic surfaces and serving as frequency determining electromagnetic resonator (hollow space resonator).

Ultra short wave electron tubes with such resonator are described f. i. in the USA Patents 2,128,233 (filing date March 1st 1935), 2,128,234 (filing date May 6th 1935) and the applications serial number 738,001 (filing date August 1st 1934) and serial number 171,148 (filing date October 26th 1937). More specifically the invention relates to electron tubes at which the surfaces of the hollow space resonator are consisting of a ceramic material coated with a cover of well electrical conductivity.

According to the invention a hollow space resonator is used being limited by the inner surface of a hollow body (which also may consist of different single parts) and the outer surface of a second body being arranged in the inner of the first mentioned hollow body and being called an inner conductor. Preferably this inner conductor is constructed as a grid along one part of its length. It is a special feature of the invention that the hollow body consists of ceramic material which is coated on its inner surface with a layer of metal being suitable for high frequency technics whilst the inner conductor preferably being built hollow, consists of metal which also may be coated with a layer of metal being suitable for high frequency technics.

The ceramic hollow body should possess small dielectric losses. Preferably such materials are suitable being based upon pure magnesium silicates. The metallic coating of the inner surfaces of the ceramic hollow body are preferably thin layers of a metal being suitable for high frequency technics f. i. silver, copper or the like. These layers f. i. can be made of a deposit by cathode rays.

A tube according to the invention has essential advantages. Compared with tubes of metallic resonator walls the tubes with ceramic walls have a smaller weight and smaller dimensions than those first mentioned. In spite of this the ceramic tube is very resistable in mechanical as well as in technical respect. The small dimensions and the small weight are of special importance, if a tube is being used in ultra short wave devices for portable stations f. i. in aeroplanes or the like.

It is further advantageous that it is possible to support safely and firmly the electrodes at the walls of the ceramic hollow body. Thus disturbances as a follow of buckling caused by heating the electrodes or parts of the walls or similar disadvantages, can be avoided largely. Also the presence of the socalled microphon effect practically can be avoided absolutely.

Furthermore it is a special advantage that at the device according to this invention the ceramic parts carrying the electrodes has a very small coefficient of expansion. The metal cover of the ceramic body serving as an electrode respectively as a resonator surface namely has consequently of its small thickness the same small thermical expansion like the ceramic body itself. Therefor it is certain that at variations of temperature the resonance frequency of the hollow space resonator practically does not vary and that already after relative short time of heating of the cathode the wanted frequency for working of the tube can be received. For getting and compensating an expansion of single metal parts in the ceramic hollow body the supports of these parts may be constructed elastically f. i. like a membrane.

It is a more preferred embodiment of the invention that not only the electrodes being formed as a cover of the ceramic walls are touching same with relatively large surfaces but also the other electrodes resp. their metallic supports touch the walls with large surfaces. Thus an extraordinary strong dissipation of heat is taking place. This loss is being caused practically exclusively by conduction of heat of the metallic parts to the ceramic walls. Furthermore those ceramic parts at the same time are able to form wholly or at least partly the wall of the vacuum vessel. The ceramic wall however is connected with the outer atmosphere and naturally for this reason is being cooled relatively well. One also can additionally cool the vacuum vessel by a cooling medium flowing round the resonator resp. flowing through channels of the wall or otherwise by radiators.

Further single features of the invention are explained by the following description of some embodiments of this invention. These are illustrated in the accompanying Figures 1–4.

According to Fig. 1 the electron tube has a resonator shaped as a concentric Lecher system. The wall of the evacuated resonator hollow space is essentially formed by a cylindric ceramic part **2** which is closed at one frontside by ceramic plate **1** whilst at the other frontside same is being closed by the also cylindric part **3** with the glass

tube 4. Parts 1, 2 and 3 are fused together by a glass fusing or an enamel fusing resp. by a conductive metal (especially semi conductor) in a high vacuum tight manner. The glass bulb 4 contains the fusings 28, 29, 30 for the direct current and the pump conduit 19 not being described separately. Instead of the glass bulb 4 also a ceramic plate closing the cylindric part 3 and containing the current leads can be used.

In the inner of the evacuated hollow space resonator the system of electrodes is arranged consisting of cathode grid and anode (resp. brake field electrode). The anode resp. brake field electrode leads into the outer conductor of the hollow space whilst the grid forms part of the inner conductor.

According to this invention the ceramic part 2 serves directly as support for the metallic outer conductor and for the anode of the tube. For this purpose the ceramic cylinder 2 on its inner surface has a cover of metal, preferably made of silver. This cover (drawn with thick lines) f. i. can be made by deposit by cathode rays or by mechanical manner and necessarily same can be burned into the ceramic wall. It is preferred to make such cover extraordinarily thin so that without difficulties it can be led through the seals of the body (f. i. at 5) to the outside thus serving as the leading-in wires for the high frequency conductor resp. the direct current conductor.

The support of the inner conductor of the resonator consisting of the grid 7 and parts 6 usefully made pipe-like according to this invention is constructed as a tilt 51 in the ceramical plate 1. The part 6 of inner conductor (made of copper) is put into the tilt and is pressed against the wall by a spring clip 8 so that also by violent motion no variations of position of the electrodes are caused. At the same time a well conduction of the heat of the electrodes is guaranteed by the thermical contact of part 6 with the wall of the tilt 51. At the other side of the cylindrical part 2 turned away from plate 1 the inner conductor 6 is supported by a corrugated metallic membrane 9 being able to equalize the variations of the length of the inner conductor caused by the heating. The membrane 9 preferably being formed like a cap is pressed against the offset 3' of part 3 by the ceramic part 10 and the spring clip 11.

The cathode is arranged in the centre of the inner conductor 6, 7. It may be constructed as a tungsten filament or with special advantage as an oxide coated cathode preferably heated indirectly. In using an oxide coated cathode an additional grid can be arranged between same and the grid 7. In Figure 1 only the end of the cathode 52 with the heating wires 29, 30 is to be seen.

At the place of the electron stream the electrodes 7 and 13 as well as the cathode have a very less distance from each other in respect to the running periods which need the electrons for their ways. For reaching a high fly wheel resistance the resonator is provided with a larger inner diameter at that point which does not form the discharge space. At the embodiment according to the invention the outer conductor 2 is forming a ring like roll 12 in the sphere of the electrode system thus forming a recess. By the safe and firm support of the inner conductor 6, 7 in the cylindric continuation 51 a punctual observance of the less distance of electrodes free from objections is guaranteed. The cylindric part 2 and the roll 12 can be made of one piece.

At the illustrated embodiment the direct current connections are provided at one side and the high frequency current connections are provided at the other side of the tube exceptional the aerial connection 23. At the embodiment the hollow space resonator to the right is continued to the concentric energy line with outer conductor 17 and inner conductor 18. The outer conductor 17 is connected preferably galvanically to the outer conductor 13 of the resonator. As mentioned above the metallic cover of the ceramic part can be led through the sealing 5 to the outside and serving as a contact with the outer conductor 17 of the energy line. In some cases the coupling can be made capacitively by the outer conductor 17 surrounding the ceramic part so far that the layers 13 and 17 are opposited each other along a certain length especially along a length of $\lambda'/4$. Here is λ' the wave length of the oscillations measured in the ceramic material.

The inner conductor 18 of the energy line is connected capacitively to the inner conductor 6, 7 by the conductor 18 surrounding the continuation 51 especially along a length being equivalent to the value $\lambda'/4$. In some cases also a galvanic contact is possible and sometimes advantageous. It can be realized by a metallic cover of the continuation 51 which is provided with a radial boring through which the metallic cover is led to the outer sphere, said boring being sealed by a glazing. Thus a galvanic contact between the conductors 6 and 18 is made.

The conducting of heat takes easier place too by the well connection between the conductors 17 resp. 18 and the ceramic wall.

The opposite end of the resonator is short circuited for the high frequency by capacities formed by the covers 14 and 15. In this manner the space 20 is discoupled for high frequency's sake, said space containing the direct current leaders and especially serving for the vaporizing of a getter (with the aid of high frequency heating). For controlling the discoupling as well as the wave length of the resonator the capacity of the covers 14 and 15 can be made variable. This can be realized by an insulating ring 16 (preferably made of ceramic) being arranged shiftable at the ceramic part 3 of the tube.

For supporting the electrode leadings through the glass wall as well as the plug pins in the drawn embodiment a separate socket 21 is provided. At another preferred embodiment at which the tube is closed by a ceramic plate instead of a glass seal the leading-in-wires are advantageously made by metallisings led through the ceramic plate. Instead of the commonly used plug pins the socket plate as connections has simple metal covers with holes. Also the leading-in wires for the direct current voltage to the anode may be led through the ceramic wall. Regarding the embodiment according to Fig. 1 the ceramic tube is bored at 23 and the metal coating is led from the inner to the outer part of the tube. F. i. the metal coating may surround the outer side of the ceramic tube 2 like a circlelike ring. The boring 23 is high vacuum tightly sealed f. i. by a glass stopper. The current leading-in wire connected with the metal coating is numbered 31. In some cases it may be better to lead the direct current voltage leading-in wire for the anode also through the socket.

For sake of protection of this arrangement an additional metal tube 22 is being provided.

In Fig. 2 an arrangement different from that of Fig. 1 is shown. At this embodiment the coupling of the outer conductor 17 with the outer conductor 24 of the resonator takes place in a

capacitive manner. To keep lesser radiation losses the arrangement is constructed in such manner that the metallising 24 is continued at 33 along the seal to the outer of the ceramic body 2. Between the metal coating 33 and the conductor 17 a further dielectric material 34 also better made of ceramic material is arranged. The coupling condenser thus has a length of λ/4. The metal protecting tube 22 already shown in Fig. 1 covers the outer conductor 17 purposely along one quarter wave length.

At another very suitable embodiment of the invention the evacuated ceramic body having an inner metal coating is forming only one part of the resonator. This simple way gives the possibility to fasten besides the evacuated part of the resonator also means for the variations of the tuning or means for the coupling, same being constructed and managed much easier than in an evacuated body. Such a device is shown in Figure 3. This device is principally constructed like the device according to Fig. 1. The resonator equivalent to a length of λ/4 and the electrode system as well as the electron stream is to be found in a potential loop. As to be seen from the drawing only one half of the hollow space is evacuated. A cylindric symmetric step like ceramic vessel is provided the inner surface being metallised and being high vacuum tightly closed at one end by a ceramic part eventually joined with a ceramic base plate. The inner conductor 6 is supported in a similar manner as per Fig. 1. The ceramic wall separates the evacuated part 36 from the non evacuated part 37. Both parts are coupled with the coating 13 serving as anode as well as the metallic part 40 of the outer resonator, this parts forming a coupling capacity. This coupling of course may be constructed as shown in Fig. 2. Furthermore a galvanic coupling is possible. The energy line 17, 18 is coupled to the resonator f. i. in such manner that the outer conductor 17 immediately passes over in the wall 39 of resonator part 37 whilst between the inner conductor 18 of the energy line and the inner conductor 6 of the resonator a capacitive coupling exists.

Figure 4 shows how part 37 of the hollow space may be varied in respect to its dimensions. The outer conductor 17 of the energy line at its end is made shiftable like a telescope and is being coupled with the wall of the resonator by a capacity 14 having in axial direction a length of λ/4 which serves besides the purpose of avoiding of radiation losses. Further-more the collar like part 41 is provided for avoiding high frequency currents at the outside of the conductor 17 thus also avoiding radiation losses.

ALFRED ALLERDING.

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BY A. P. C.

A. ALLERDING

ELECTRON TUBE DEVICE FOR ULTRA SHORT WAVES

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Fig.1

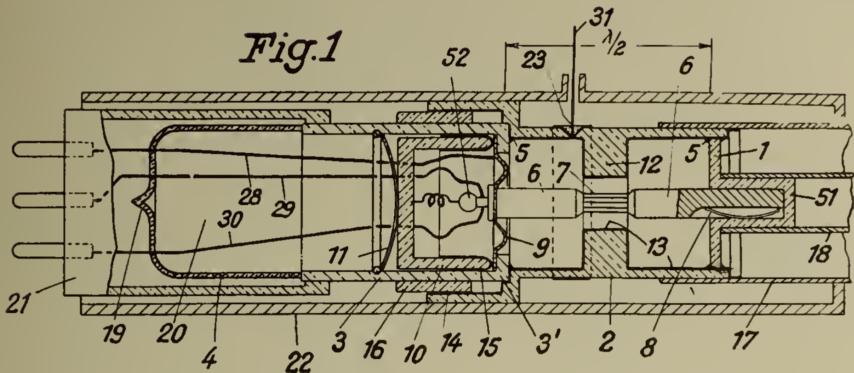


Fig.2

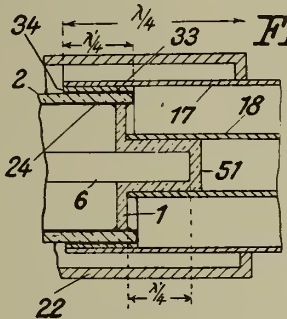


Fig.3

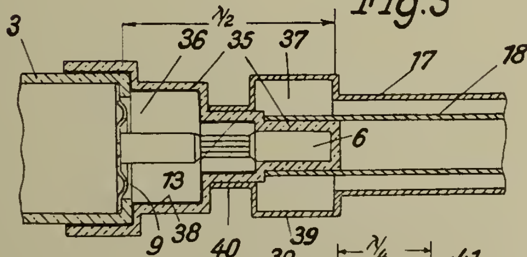
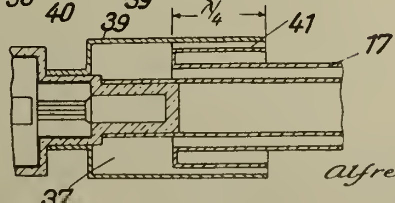


Fig.4



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ATTORNEYS

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ALIEN PROPERTY CUSTODIAN

SPEAKING MACHINES

Gustav Fries, Berlin-Charlottenburg, Germany; vested in the Alien Property Custodian

Application filed May 14, 1941

The present invention relates to speaking machines or instruments provided with means for scanning a circular band.

It is well known that in film apparatus serving the purpose of recording and/or reproducing acoustic events the means for effecting tranquillization of the running off of the film must be particularly carefully constructed so that the quality of the acoustic events is not reduced by disturbances of a mechanical kind. To this purpose devices have been developed by which the film is to be led along the sound control point in a particular quiet or calm manner and which are formed as mechanical filters, brakes and the like.

Tranquillization of a film is rendered particularly difficult if the running off film is re-wound as circular film reel. This also is accompanied by a special consumption of power.

For this reason devices have been proposed for the re-winding of known circular films which with more or less expense are to allow a simple re-winding consuming little power.

However, hitherto the further problem has not yet been solved i. e. to re-wind free of objections circular films of substantial length for the purpose of sound recording and sound reproducing.

Now, the present invention is concerned with this problem which is solved by the fact that for re-winding a circular film two reels are concentrically arranged upon the axis of a disc record speaking machine one above the other, whereby for guiding the film the ordinary driving gear of the plate of the speaking machine and for scanning a speaking head guided in parallel are provided. Therefore, according to the invention a normal driving gear of disc records or a device of similar construction is used in such a manner that the plate, carrying the disc record, serves as support for the circular film and that the film is guided around a drum the axis of which forms the prolongation of the axis of the plate, carrying the disc record and which drum is directly driven by the axis of the plate so that the film, leaving the interior of the circular film reel and moving over the drum along the control point exteriorly runs upon the circular reel again.

This device allows in the most simple manner the re-winding of a circular film reel of considerable length (200 m) and simultaneously results in such a tranquillized running of the film at the point of control that special means for obtaining tranquillization of run at the point of control are superfluous.

Moreover, with a driving gear of the plate, supporting the disc record, making as usual 78 revolutions per minute, a film speed at the point of control of 10–80 cm per second may be obtained by using drums of different diameter for leading the film along this point of control without, thereby, influencing the run of the film, or the tranquillization of run, or rendering the demand of power larger than the power supplied by the plate driving gear for instance.

The fact that the demand of power for re-winding even the longest circular film reels may be so small is due to the peculiarity of the device, and the action is based on this that the film, running upon the outer edge of the circular film reel, tends to run faster with this film in accordance with the larger diameter and in this manner causes a pull which directly reacts upon the drum and tends to accelerate the speed of the latter. In this manner a mechanical back-coupling results so to say which is accompanied by an economy in output.

In the accompanying drawings one construction according to the invention is shown by way of example.

In these drawings:

Fig. 1 is a perspective view of the general construction of the device,

Fig. 2 is a perspective detail view of one end of a bridge shown in Fig. 1,

Fig. 3 is a vertical section on the line *a—b* in Fig. 1,

Fig. 4 is a plan view illustrating the movement of the control point in horizontal direction,

Fig. 5 is a view showing the movement of the control point in vertical direction, and

Figs. 6 to 8 show details of the reel formation.

As shown in Fig. 3 the plate **4**, supporting the disc record is fixed by a cone **3** upon the shaft **2** of the motor **1** of a driving gear of a speaking machine. The prolongation of the shaft **2** has a left-hand thread **5** as is used in a manner known per se for fixing record foils for the purpose of sound recording.

To reduce as far as possible the friction of the individual layers of the circular film reel **6** it is of importance to arrange upon the plate **4** and between the latter and the reel **6** a plate **7** of glass or other hard and polished material.

The drum **8**, serving to lead the film **9** along the control point **10**, is, by means of the shaft **11** and the disc-like enlarged lower end **12** of the latter, fixed by means of the left-hand thread **5** centrically and free of shocks to the shaft **2** of the plate **4**.

Besides the drum **8** a guide disc **13** is attached to the shaft **11** in the height of about one half

the width of the film. The disc 13 has about the same diameter as the drum 8 and serves to prevent that the film 9 running out of the circular reel 6 may eventually reach the shaft 11 which in the present case might disturb running off free of objections.

Upon the bridge 16, carrying the rollers 14 and 15 and the control member 10 and resting upon the posts or uprights 17 and 18, guide members 19 and 20 are mounted (Fig. 1) which serve to laterally guide the film 9 and cause an absolute rectilinear guidance of the film 9 along the control member 10.

After loosening the fixing screws 21 and 22, the bridge 16 may be turned around the post or upright 18 for the purpose of exchanging the film. As shown in Fig. 2 the bridge 16 is provided with a recess to allow removal from the post or upright 17.

The lower film reel 6 then lies perfectly free and may be removed as easy as a disc record for instance. The upper film reel is designated 39. The insertion is just as easy, because, after placing the film reel 6 upon the plate 4 carrying the disc 7, the film running out of the inner reel is, when the bridge is moved towards the operative position, arranged between the guide members 19 and 20 and on closing the bridge 16 is automatically brought into the proper position around the drum 8 by the rollers 14 and 15.

To ensure running off of the film between the guide members 19 and 20 around the drum 8 without causing compression of the film material, and also ensuring that the film perfectly rests upon the drum, the roller 14 at the running off side only is formed as a pressure roller which is drawn against the drum by a spring 23, whereas the roller 15 serves to closely guide the film 9 towards the drum 8 only.

Preferably the upper surface of the drum 8 is coated with gum in a manner known per se to ensure good driving of the film.

To warrant a rather concentric rotation of the circular film reel 6 about the shaft 11 an adjustable finger 24 is provided against which the film reel bears with slight pressure during rotation. As the friction is very slight, the use of rollers is not necessary here.

Only for reels of greatest length of film (from about 150 m upward) a roller preferably is provided at the holding rod 25 for guiding the film round the latter.

As the control member 10 for scanning of films or disc records must be properly guided vertically as well as horizontally a specially constructed holder 26 is provided.

The holder 26 acts in the manner of a weighing table for the vertical scanning. The pivot of the weighing table is located at 27 and the weight of the control member 10 is balanced by the counter weight 34. By means of a spring 28, a needle 29 serving for film scanning is slightly pressed against the film and thereby is guided for instance in the groove out in the film.

For horizontal scanning, the control head 10 is turned about 90° so that for instance the needle 29 comes to rest upon the disc record. The pivot of the holder 26 is now located at 30 and a link 31 with a lever 32 at the control head 10 and the pivot 33 causes that for instance the needle 29 in the groove of the disc record always is located in the direction of the tangent to the diameter, when moving over the disc record.

This is represented in Fig. 4 in which the needle 29 is shown at 35 in the position at the inner radius of the disc record, whereas this is indicated at 36 at the outer radius with a diagrammatic view of the leverage 31*a*/32*a*. It is to be seen that for this way the correction of the position of the needle with regard to the tangent would amount to about 25° relatively to the position over the way 37 which the needle would perform, if the pivot of the holder 26 would be at 30 and the holder would be rigidly connected to the control head 10.

The rectilinear guidance of the sound control point 10 along the film 9 is of particular importance, if magnetic or photographic records come into consideration as these are effected by means of magnetic or optical gaps and hereby an inclined position of the scanning gap relatively to a straight record would cause a considerable sound distortion. For scanning a sound groove by means of a needle it is not so critical, if the length of the way from the point of the needle 29 to the pivot 30 or 27 respectively is rather large, because the point of the needle is punctiformly guided in the groove.

This is known from the usual sound take off device for disc records.

If the holder for the control head is positively guided, then by employing corresponding control heads, the device may be used for recording and reproducing acoustic events in accordance with all known methods for recording and reproducing.

A substantial advantage of the invention consists in the fact that practically no upper limits exist for the length of the reel as may be gathered from the following consideration.

In the drawing in Figs. 1 and 3 the second reel 39 located above the first reel clearly is to be seen. The reel 39 is concentrically located above the reel 6. This second reel 39 rolls off about the drum 8. It consists of one winding only which, when being considered from above, represents a closed winding and, therefore, technically must be designated as a reel, because a reel begins with the first layer and, therefore, may be of one layer only and yet be a reel. Fig. 6 represents this formation. Of course, this second reel may also be of several layers and yet the rewinding of the endless film is possible free of objections, as has been shown by tests (Fig. 7). From these tests the possibility results that reels of any desired number of layers may be arranged one above the other to re-wind endless films of any desired length, for instance to produce picture recording cameras in which a single loading with film in the dark room is sufficient for an uninterrupted time of taking pictures of several hours (see Fig. 8). This serves to further explain the device claimed in the main claim.

Finally, a special peculiarity in the concentric arrangement of reel layers of an endless film one above the other is, that even with films having an upper surface sensitive to friction, for instance a light sensitive layer, this upper surface is not subjected to the danger of a strong wear and means for protecting such surfaces, such for instance, as forming the subject matter of older patents are rendered superfluous with the arrangement according to the present invention.

GUSTAV FRIES.

PUBLISHED

MAY 25, 1943.

BY A. P. C.

G. FRIES

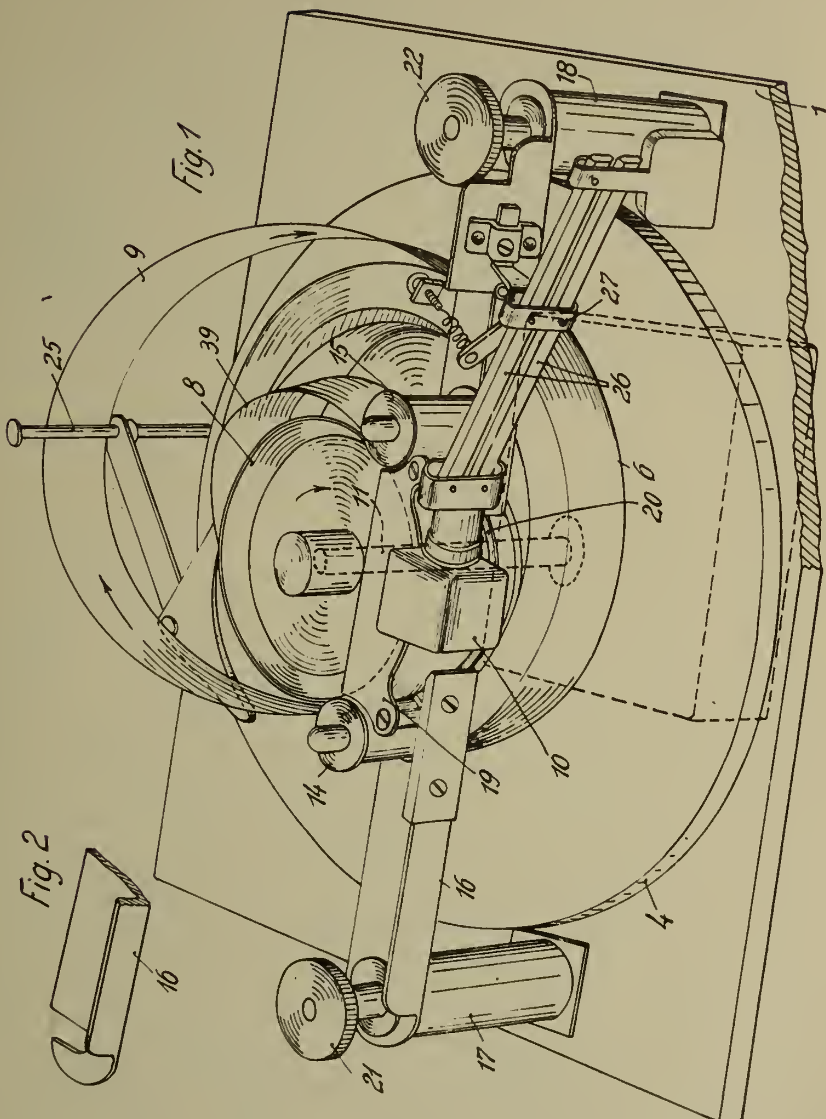
SPEAKING MACHINES

Filed May 14, 1941

Serial No.

393,493

3 Sheets-Sheet 1



Inventor:

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Fig. 3

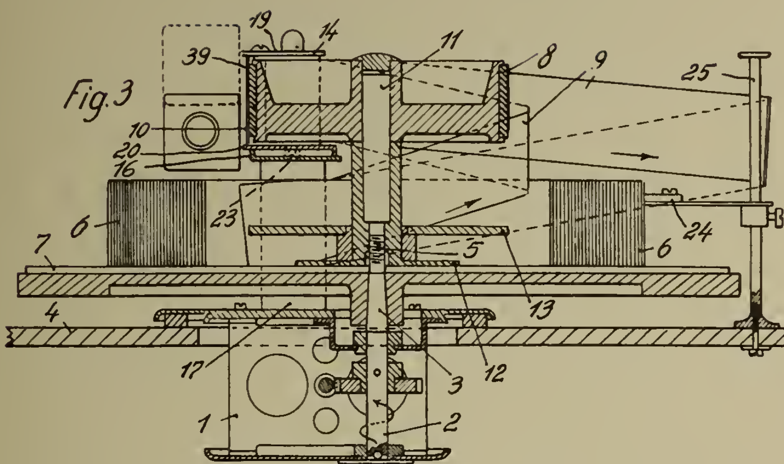

Fig. 4

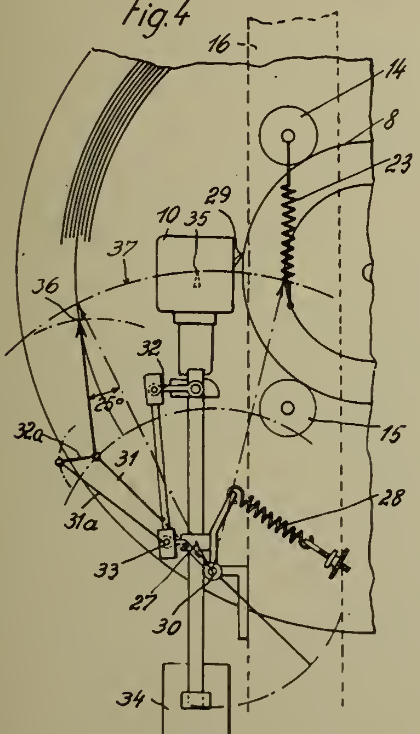

Fig. 5

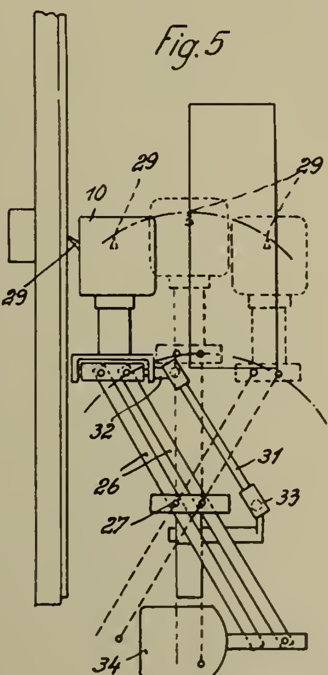

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Fig. 6

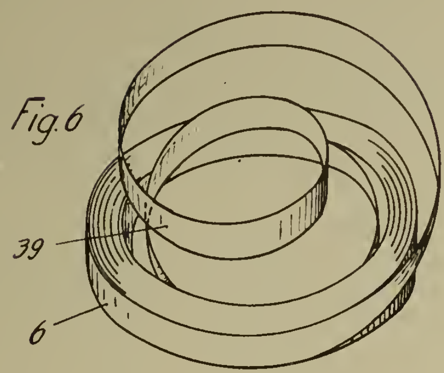


Fig. 7

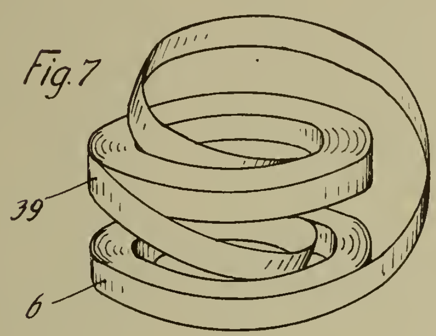
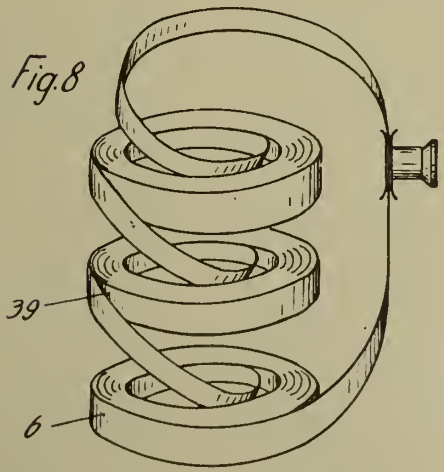


Fig. 8



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Serial No. 394,322

ALIEN PROPERTY CUSTODIAN

REGULATING INTERNAL COMBUSTION ENGINES

Fritz Gosslau, Berlin-Charlottenburg, Johannes Schmidt, Berlin-Eichkamp, and Georg Weiche, Berlin-Reinickendorf-West, Germany; vested in the Alien Property Custodian

Application filed May 20, 1941

The present invention relates to internal combustion engines, and more particularly to devices for regulating internal combustion engines.

This application is a divisional application based upon certain subject matter contained in our prior copending application Serial No. 233,-728, filed October 7, 1938.

Broadly, it is an object of the invention to provide regulating devices which are adapted to control the fuel supply of internal combustion engines.

More specifically, it is an object of the invention to provide regulating devices which are adapted to automatically keep constant the weight of the air in relation to the weight of the fuel.

It is still a further object of the invention to balance by means of a balance beam the difference of the static and the dynamic pressure of the air passing through the air intake on the one hand, and of the pressure prevailing inside and outside of the fuel injecting nozzle on the other hand, and to thereby control the fuel supply of internal combustion engines.

It is another object of the invention to control the fuel supply of internal combustion engines by balancing by means of a spring the difference of the static and the dynamic pressure of the air in the air intake, and by further balancing by means of a second spring the difference of the pressure inside and outside of the fuel injecting nozzle.

It is still an object of the invention to provide a regulator controlling in turn the fuel supply, said regulator being dependent upon the difference of the static and the dynamic air pressure in the air intake, and further upon the state of the air in such a manner that the regulator depends upon the ratio of the effective air pressure and of the specific volume of the air.

It is still another object of the invention to provide a device which allows a particularly favorable utilization of the fuel reserve of the engine. Our novel regulating device has, for instance, the advantage that aircraft provided with such regulators have a range of flight which is greater than with the use of the hitherto known regulating devices.

It is still a further object of the invention to provide a regulating device which under all service conditions operates free of objection and also, as is required e. g. in the aircraft arts, in a very great height above the earth.

It is still an object of the invention to provide a device which practically never requires operation of the person controlling the engine, for instance of a pilot.

It is still another object of the invention to provide a regulating device which automatically adjusts definite mixture ratios of air and fuel particularly when using various kinds of fuel.

The novel regulator forming an object of the invention is e. g. so constructed that the measuring device influenced by the pressure differences of the air drawn in in the air intake acts upon the spring load of the overflow valve of a pressure pump which feeds the fuel by way of nozzles into the charging pipe.

In accordance with a modification of this construction, the adjusting members of the device for measuring the quantity of air also may be used to alter the internal cross section of the fuel nozzle.

In order to measure the difference of the static and of the dynamic pressure of the air in the air intake Venturi nozzles or throats may advantageously be inserted into the air intake. Instead of the Venturi throat any other known measuring instrument may be used. However, Venturi nozzles have the advantage that practically no throttle losses occur.

These and other objects of the present invention will become more evident in the following description taken in connection with the drawings, in which:

Fig. 1 is a diagrammatic representation of a construction of the regulator which is particularly characterized by a doubly controllable main regulating member.

Fig. 2 is a diagrammatic representation showing in detail a modification of the construction illustrated in Fig. 1.

Fig. 3 is a diagrammatic representation of a further modified embodiment of the regulator wherein the pressure difference prevailing at the fuel nozzle is utilized for effecting the control.

Fig. 4 is a view of a detail of the construction shown in Fig. 3.

Fig. 5 is a diagrammatic representation of a further modification of the regulator according to which the pressure difference in front of and behind an air nozzle as well as the pressure difference inside and outside of the fuel nozzle is utilized for controlling regulator members.

Fig. 6 is a vertical section of a modified detail of the construction shown in Fig. 5.

Fig. 7 shows two regulator diagrams relating to the devices of Figs. 5 and 6,

Fig. 8 is a diagrammatic representation of a

modified construction of the device shown in Fig. 5.

Fig. 9 is a regulator diagram relating to the device of Fig. 8.

A particularly simple regulating device according to the invention is obtained by constructing the main regulator controlling in turn the fuel regulator in the following manner. The main regulator is doubly controllable, i. e., on the one hand by the effective pressure of the stowage and quantity measuring device which may be a Venturi tube and on the other hand, by the state and in particular by the density of the air in front of the stowage point of the measuring instrument. Preferably, the doubly controllable main regulator is so constructed that the same operates in accordance with a ratio of the effective pressure Δp to the specific volume v of the air in front of the stowage point of the quantity measuring instrument.

According to a preferred modification of the device for regulating the fuel mixture, the main regulator controlling the fuel regulator is provided with a box filled with air which may be influenced by the state of the air prevailing in front of the Venturi tube or the like, and which in turn controls members, for instance valves, by means of which the effective pressure of the Venturi tube attacking the main regulator may be influenced for instance according to the ratio

$$\frac{\Delta p}{v}$$

According to a modification of this construction the box, influenced by the effective pressure of the Venturi tube, is arranged in a chamber connected to the smaller pressure reducing cross section of the Venturi tube, whereas the box, influenced by the state of the air, is arranged in another chamber separated from the first chamber and connected to the larger pressure reducing cross section of the Venturi tube. Ports are provided in the wall separating the two chambers, which ports, on the one hand, communicate with a pipe connected to the interior of the box, influenced by the effective pressure, and, on the other hand, communicate with a pipe which may be closed by the valve body controlled by the box influenced by the state of air, the size of which may be altered. These ports freely discharge into the space which contains the box influenced by the effective pressure.

Preferably the cross section F_1 of the discharge end of the effective pressure pipe of the Venturi tube connected to the chamber of the box influenced by the effective pressure is invariable, whereas the regulatable cross section F_2 of the valve provided between the two chambers may be altered in accordance with the law; specific volume

$$v = \text{const.}\left(1 + \left(\frac{F_1}{F_2}\right)^2\right)$$

The above described regulating device may further be simplified by directly connecting the just described doubly controllable regulator to the regulator controlling the fuel admission, so as to form a single operating unit.

By this construction, the regulating possibilities also are increased and the scope of the regulating range is enlarged.

For instance, with the most simple additional means a more exact adjustment of the regulation of the mixing ratio of air and fuel may be obtained due to the excellent operation of the entire device. To this end it is for instance sufficient to provide an adjustable throttle of a known type in the pipe leading from the fuel pump to the spray nozzle for the mixing device. For the purpose of obtaining further regulation of the mixing ratio of air and fuel it may, moreover, be sufficient to construct the nozzle injecting the fuel into the mixing device so as to be capable of being shut off.

Another very simple additional means for further improving the regulation may consist in providing the air quantity measuring instrument and the device producing the stowage pressure, for instance a Venturi tube, with members for adjusting the size of the cross section of the air flow. For this purpose, for instance, a streamlined body which preferably may be shifted axially and therefore allows an alteration of the narrowest cross section of the tube may be arranged in the interior of the Venturi tube.

The doubly controllable main regulator and the regulator connected thereto and directly acting upon the fuel admission may eventually be connected together by way of a tilting lever, the pivot pin of which is adjustably arranged to allow the setting of a definite mixing ratio of fuel and air.

The regulator directly acting upon the fuel admission preferably is provided with a return pipe which may be controlled by the valve member of the regulator and which serves to return fuel which has been fed in excess to the suction side of the pump. We have found that this construction of the regulator may advantageously be improved by providing the valve member with a special throttle member arranged in the pipe between the fuel pump and the nozzle and serving for influencing, and more particularly for reducing the fuel pressure. Moreover, a spring biasing the valve member and influenced by the pressure prevailing at the injecting point of the nozzle is provided which acts upon this member and tends to shift same in a definite direction.

The just described construction may, for instance, advantageously be used for the following conditions.

The valve member of the fuel regulator which may be a piston, is loaded, on the one hand, by the pressure difference prevailing at the fuel nozzle and, on the other hand, by a spring the tension of which may be altered by the doubly controllable main regulator. The above mentioned valve piston allows return flow of fuel fed in excess to the suction side of the pump in such a manner that the pressure difference corresponding to the tension of the spring is regulated. Now, the pressure at the injecting point of the nozzle may fall substantially below atmospheric, for instance if the motor is strongly throttled. However, as the pressure in the pump always corresponds at each instance to the outer pressure, and would be too high for the just described operating conditions the pressure of the pump is reduced to permissible values and is simultaneously brought into equilibrium with the tension of the spring acting upon the valve piston by means of the throttle member arranged in the pipe between the fuel pump and the nozzle and connected to the valve piston of the fuel regulator.

We have further found that the just described regulator may, with the use of simple means, be constructed for actuation by hand also so that

in case the automatic operation fails the device may still be operated.

For this purpose preferably a hand actuated lever is provided which also attacks the control rod of the fuel regulator actuated by the doubly controllable main regulator. The control rod bears positively, for instance by spring action, against the control member rigidly connected to the doubly controllable main regulator in such a manner that the control rod may, by means of the lever, be disengaged from the control member of the main regulator. Preferably, the hand lever is so journalled and linked to the control rod that during operation of the main regulator the lever idles. On actuation by hand, the lever coupled, for instance, to the control lever may be used to prevent an undue drop of the pump pressure and may also be used to limit the ejected quantity of fuel to that value which just still allows operation of the motor. To this end a stop formed as a cam may be provided for the hand lever by means of which the swinging amplitude of the lever may be changed.

With the hand lever it is, moreover, possible to control the pump pressure as far down as to idle running, if for instance at smaller outputs the limit of response of the main regulator should be reached. To this end, the hand lever is connected to the regulator members and is so set that it automatically takes care of the setting of the pump pressure as soon as the lower limit of response of the regulator is reached.

An embodiment of the device above referred to is shown in Figs. 1 and 2 of the drawings.

The internal combustion engine has a crank case 601 to which the cylinder 602 for the piston 603 is connected which, by way of the piston rod 604, is connected to the crank pivot 605 of the crank arm 606. Crank arms 606 may be rotated around the axis 607. Driving gears not shown in the drawings are mounted upon shaft 607 for transmitting the torque to the charger provided with a spiral casing. The charger is, therefore, directly driven by the internal combustion engine. Outlet valve 609 controlling the size of the discharge opening 610 is arranged at the cover 608 of cylinder 602 and in front of piston 603. Inlet valve 611 is provided at the cylinder cover 608 controlling the size of the inlet opening 612. The outlet opening 609 discharges into the exhaust 613. Pipe 614 is connected to the inlet opening 612 the other end of pipe 614 being connected to the spiral casing 615, 616 of the charger. The blades 617 of the charger are mounted on the supporting body 618. The supporting body 618 is rigidly mounted in an overhanging manner upon shaft 619 which, as mentioned before, may be rotated by means of members, not shown in the drawings, by shaft 607 driven by the internal combustion engine.

The charger 615 to 619 draws in the air by way of a tube 620 enlarged like a diffusor. Tube 620 tapers at the end remote from the charger towards its smallest cross section at the point 621 and from this point enlarges again. Radially outwardly directed ports 623 are provided in the wall of enlarged tube-like portions 622, parts 623 being surrounded by an outer annular casing 624. One of the pipes serving to transmit stowage pressure to the regulator is connected to casing 624, as will be described hereinafter.

A shoulder like projection in the form of an outwardly extending enlargement is provided behind the enlarged projection 622 of the stowage pressure producing device and shaped for instance as a Venturi tube. At this place radially outwardly directed ports 625 are provided in the wall which exteriorly are surrounded by an annular casing 626 which is connected with the other of the two pipes for transmitting the stowage pressure to the main regulator, as will be described hereinafter.

A streamlined valve body 627 is arranged in the interior of tube 622 at the portion tapering in the direction towards the charger. Preferably, valve body 627 is formed as a rotary body, the axis of which coincides with that of tube 622. Body 627 is axially displaceable and, when moved towards the charger, the cross section of the annular space formed by body 627 and the surrounding wall of tube 622 is reduced.

Cylindrical tube 628 is connected to tube 622 and extends from the end remote from the point of smallest cross section. Throttle flap 629 is arranged in tube 628 and is pivotally mounted on pin 630. Flap 629 may be rotated by means of a linkage. This linkage comprises of lever 631 rigidly connected, on the one hand, to the throttle flap 629, and, on the other hand, to lever 633 by way of link 632. Lever 633 in turn is connected, by means of link 634, to lever 635. Lever 637 swingably mounted on the pivot 636 is connected to lever 635 and adapted to be actuated by hand.

The pipe transmitting the effective pressure Δp of the Venturi tube 620, 621, 622 upon the main regulator is designated with 638, whereas 639 designates the pipe conducting the pressure in front of the Venturi tube to the main regulator. Pipe 639 discharges by way of connecting socket 640 of regulator casing 641 into chamber 642 of casing 641. By means of wall 644 chamber 643 is separated from the first chamber 642. One or more ports 645 are provided in the wall 644. Wall 646 closes both chambers 642 and 643 against a third chamber 647 provided in casing 641. Socket 648 is provided on the outer wall of chamber 647. Pipe 638 leading from the Venturi tube extends into socket 648 so that the interior space of chamber 647 is connected with the point of the Venturi tube producing the effective pressure.

Diaphragm box or bellows 649 is arranged in the interior of chamber 647. Bellows 649 acts by way of centrically projecting intermediate members 651 upon the main regulator 652 and controls the latter in accordance with the effective pressure Δp of the Venturi tube. Diaphragm box 649 is provided with a socket 650, one end of which discharges into the interior of box 649 and the other end of which is tightly passed through wall 646 and discharges into chamber 642 to which pipe 639 is connected which supplies the pressure prevailing in front of the Venturi tube.

Another box or bellows 653 is provided in the interior of chamber 643 which, in a manner known per se, is filled with air and expands in accordance with the state of the air v (specific volume) in front of the Venturi tube. Space 643 surrounding box 653 is, as described above, connected, by way of ports 645, to chamber 642 and also to pipe 639 transmitting the pressure prevailing in front of the Venturi tube.

Bellows 653 actuates control slide 654 which is influenced by spring 655. Slide 654 opens and closes a by-pass 656 provided in the wall between chambers 643 and 647.

If by-pass 656 is opened by control slide 654, a flow is effected from the Venturi tube into chamber 643 and then by way of the variable throttle

opening 656 having the cross section F to chamber 647 and then by way of the invariable throttle opening F_2 of the outlet socket 648 back to the Venturi tube 620—622. It may be proven that with this direction of flow the effective pressure Δp of the Venturi tube is reduced in accordance with the ratio

$$\frac{1}{1+\left(\frac{F_1}{F_2}\right)^2}$$

If according to the invention the cross section F_1 of the throttle pipe 656 is so chosen that the just mentioned value

$$1+\left(\frac{F_1}{F_2}\right)^2$$

is proportional to the value v (specific volume of the air), the regulating device operates in accordance with the law

$$\frac{\Delta p}{v}$$

aimed at. In accordance with this value the regulating member sets the pressure differences Δp_{Br} of the fuel pump. Therefore, the weight of the air and the weight of the fuel have a definite predetermined proportion.

The slide 654, moreover, simultaneously serves as a safety member against unduly high effective pressures. In case the effective pressure becomes too high control slide 654 is lifted from box 653 and thereby the pressures in the chambers 643 and 647 is equalized.

Control member 657 which may be a rod projects from regulator 652. Main regulator 652 shown in Fig. 1 directly acts by means of rod 657 upon a control valve of the fuel regulator connected with the fuel pump.

Control member 657 cooperates with its free front face with the front face of a further rod-like control member 665 so that both control members may be positively coupled to each other by means of a spring. Link 658 is connected to the control rod 665 of the fuel regulator. Double-armed lever 659 pivotally mounted upon bolt 660 controls rod 665 by the intermediary of link 658. The free end of double-armed lever 659 cooperates with cam 661 which, for instance, is provided with a spirally extending control face 662 and which may be rotated around axis 663. Control disc 661 is eventually positively connected to hand lever 637 by means of a transmission device 664 shown schematically only. The transmission may be effected in such a manner that by adjusting hand lever 637 cam disc 662 also is adjusted, whereby simultaneously the oscillation amplitude of double-armed lever 659 is determined.

Control face 662 of cam disc 661 corresponds in accordance with the invention nearly to the poorest mixing ratio which still allows operation of the motor. In case the main regulator 652 fails, cam 661 takes care of the control, whereby plunger 665 is lifted with regard to control rod 657 of main regulator 652 which otherwise is positively coupled to plunger 665. By means of cam disc 661 the fuel regulator or the fuel pump are also controlled then, when the limit of response of the main regulator is reached. For instance the regulation of the motor by hand may be set for a range of .25 of 1% of the normal output.

Flanged disc 666 is provided at the end of plunger 665 projecting into the interior of the fuel regulator. Disc 666 is axially movable in cylindrical space 668 of regulator casing 667 against the action of a spring, e. g. coiled spring 669. One end of spring 669 bears against flanged disc 666, whereas the other end bears against the bottom of dish-like piston 670, fixed to rod 671. Rod 671 projects axially from the outer surface of the bottom of piston 670. The free end of rod 671 carries flanged disc 672 serving as throttle member and operating in cylindrical space 673 of fuel regulator casing 667. The diameter of cylindrical space 673 is relatively very much larger than the one of flanged disc 672.

Flanged disc 672 causes an additional throttling of the fuel flowing to the fuel nozzle. By means of flanged disc 572 it is possible to reduce the pressure in front of the nozzle below the outer air pressure. Rod 671 carrying disc 672 is movably arranged in cylindrical space 674 which is partially shut off from cylindrical space 673 by annular projections 675 projecting from the wall of casing 667. The diameter of the interior space reduced by projections 675 practically is as large as the diameter of throttle disc 672 so that the latter may shut off space 673 against space 674.

Outlet socket 676 for the fuel is provided in front of the free front face of throttle disc 672. Pipe 677 leading to the fuel nozzle 681 is connected to socket 676. In pipe 677 a known throttle member 678 having an adjustable throttle 679 is arranged. Pipe 680 connects throttle member 678 with nozzle pipe 681 arranged obliquely to the axis of pipe 680. Nozzle pipe 681 projects through the wall of spiral casing 615, 616 of charger 617, 618 and discharges with its nozzle mouth into space 616 of spiral casing 615. Needle valve 682 is provided in the interior of nozzle pipe 681 and controls and eventually shuts off e. g. the discharge opening. Throttle member 682 e. g. may be adjusted by hand in the same manner as throttle member 679.

Channel 683 provided in socket 684 connected in turn to the pump casing discharges into cylinder space 674 of regulator casing 667. In the example shown the pump is constructed as a geared pump having two gear wheels 685 and 686 which rotate in the direction indicated by the curved arrows and thereby feed fuel as indicated by the straight arrows from the supply pipe 687 into pipe 683 and therefrom by way of pipes 677 and 680 to nozzle 681.

From the supply pipe 687 by-pass channel 688 branches in front of the toothed wheels of the pump. By-pass channel 688 discharges into space 689 provided in the interior of regulator casing 667 adjacent cylindrical space 674. Space 689 is separated from space 674 by annular projections projecting from the walls of casing 667. Overflow piston 670 also partly moves in space 689. Pipe 690 discharges into cylindrical operating space 668 of overflow piston 670 and the other end of pipe 690 is connected to space 616 of charger casing 615.

Piston 670 is by way of collar-like throttle disc 672 biased with the pressure prevailing in front of the fuel ejecting nozzle 681. The upper side of piston 670 is subjected to the pressure prevailing in the spiral casing of the charger, i. e. behind the nozzle 681. The face of piston 670 influenced by this pressue is also influenced by spring 669, the tension of which may be altered by main regulator 652 by way of the linkage 657, 665, 663.

This last explained action of main regulator 652 upon the linkage 665, 666 and piston 670 is

effected directly in the embodiment of the invention shown in Fig. 1. If in this embodiment the mixing ratio between air and fuel is to be altered, then the above described adjustable throttle devices 678, 679 arranged in fuel pipe 677 leading to nozzle 682, and the nozzle control device 681 are used. The mixing ratio between air and fuel may also be altered by axially displacing streamlined valve body 627 in Venturi tube 620, 621, 622.

A modified construction of the power transmitting linkage between the doubly controllable main regulator 652 and the control valve of the fuel pump is shown in Fig. 2. Like parts are designated by the same reference characters in Figs. 1 and 2.

Axially shiftable rod 691 loosely bears against plunger 665 which is attacked by double-armed lever 659 by way of link 658. Rod 691 is provided with ball-shaped member 693 which is surrounded by fork 694 provided at the end of arm 697. Arm 697 is connected, by means of bolt 698 attached to its other end, to control rod 657 of main regulator 652 and bears upon a knife-edge 699. Opposite ball 693 rod 691 continues as rod 695 displaceably arranged in bearing body 696 which also forms a bearing for knife-edge 699.

With the aid of tilting lever 697 the mixing rato between air and fuel may in a simple manner be changed by shifting pivot point 699 of lever 657 for instance upon its bearing.

Another modification of our novel regulating device shown in Figs. 3 and 4 is particularly characterized by its great simplicity and by the fact that it automatically sets the desired mixing ratio independent of the state of the air at each instant.

To this end the invention utilizes the knowledge that with invariable density of air and with a definite mixing ratio the effective pressure of the measuring device for the air quantities bears a certain relation to the pressure difference prevailing in and behind the fuel nozzle. This knowledge is utilized by providing a pressure scale or balance beam influencing the fuel control valve. The pressure scale provided in connection with the fuel mixture regulator is subjected, on the one hand, to the action of the pressure difference of the instrument measuring the air quantities and, on the other hand, to the pressure difference prevailing at the spray nozzle.

A further feature of the invention consists in the use of a control slide relieved of the pump pressure, the control slide being independent of the number of revolutions of the fuel pump or, as the case may be, independent of the characteristic of a spring, i. e. of the spring constant.

In Fig. 3 a single cylinder motor is shown for the sake of simplicity. Piston 702 is arranged in cylinder 701 and is connected by means of piston rod 703 to crank 704 of crankshaft 705. Fuel pump 706 is connected to one end of crankshaft 705. Fuel pump 706 is formed in a known manner as a geared pump and therefore a detailed showing and a description thereof is deemed unnecessary. Gear wheel 707 is mounted upon the other end of crankshaft 705 and cooperates with gear wheel 708 fixed upon shaft 709 of rotor 711 of the air blower. Spiral blower casing 712 is connected to pipe 713 leading to inlet valve 714. The outlet valve is shown at 715. The suction space of the blower is formed as a Venturi tube 716. Throttle flap 717 is arranged in front of Venturi tube 716. Tapping 718 is provided at the point of Venturi tube 716 where the highest air velocity prevails. The air pressure, i. e. the effective pressure, prevailing at tapping 718 indicates the quantity of air flowing through tube 716 in the unit of time. In front of point 718 further tapping 719 is provided at the point, where stowage of the drawn in air begins.

Fuel injecting nozzle 721 is provided in the walls of blower casing 712 and behind nozzle 721 a tapping 722 is provided for measuring the air pressure prevailing in casing 712 behind nozzle 721.

Pipe 723 leads from the tapping of the Venturi tube to channel 724 provided in regulator casing 725. Pipe 726 leads from tapping 719 of the Venturi tube by way of pipe 727 into regulator casing 725. A cylindrical space is provided in casing 725 wherein piston 728 may freely move up and down. Pipe 727 transmitting the stowage pressure discharges into the space above piston 728, and channel 724 carrying the effective pressure discharges into the space below piston 728. Piston rod 729 bears against a balance beam 731 which may be swung around prism 732. The other end of balance beam 731 is connected to slide 733 provided in a cylindrical recess of casing 725. Slide 733 is provided below its cylindrical head portion 734 with a projection 735 of reduced cross section so that an annular space 736 is formed in the cylinder space of casing 725. Below annular space 736 slide 733 enlarges again to form cylinder 737 of a cross section corresponding to that of slide head portion 734.

Pipe 738 branching from fuel pump 708 discharges into annular space 736. Head portion 734 of piston slide 735 carries a lateral groove 739 which in plan view has the form of a triangle. Groove 739 allows the fuel flowing from pipe 738 into space 736 to flow by way of triangular groove 739 into space 741 above slide 736. According to the height of slide 736 with regard to the bottom edge 742 of space 741 more or less fuel may flow into space 741. Pipe 743 leads from space 741 to fuel nozzle 721. The lower end 744 of piston slide 733 also is of cylindrical shape so that it restricts space 745 below slide 733. Pipe 746 leading from tapping 722 in blower casing 712 discharges into space 745.

Pivot 732 around which balance beam 731 may be swung is formed as a prism which may easily be shifted upon surface 747. For this purpose rod 748 is provided which leads into a special fluid-tight casing 749. Rod 748 is connected in casing 749 with a box or bellows 751 acting as barometer. On the other hand, bellows 751 is maintained in its position by rod 752 linked to hand lever 753 which may be fixed in its position. Pipe 754 which, by way of pipe 726, is connected to tapping 719 discharges into casing 749.

The above described device operates as follows:

Supposing e. g. the number of revolutions of the motor increases, while the position of throttle flap 717 remains invariable. Due to the increasing number of revolutions more air is drawn in by Venturi tube 716. Therefore, however, the pressure prevailing at tapping 719 will be higher than that prevailing at tapping 718. Consequently, the upper surface of piston 728 is heavier loaded than its lower surface so that the piston starts to fall. Hence, lever 731 is swung in such a manner that control piston 733 is displaced upwardly. More fuel may now flow from space 736 by way of triangular groove 739 into space 741. The fuel flows into space 741 until the higher

pressure built in space 741 is in equilibrium with piston 728.

Simultaneously with the described operations, the pressure ratios prevailing at the fuel nozzle 721 and at the tapping 722 of the blower casing also change. The higher number of revolutions of blower rotor 711 causes an increase of the pressure at tapping 722 which is transmitted by way of pipe 746 into space 745. The increasing pressure in space 745 acts in the same manner as the increasing pressure above piston 728.

With decreasing output or efficiency of the motor, the described operations are performed in the reversed direction, and it is obvious that any change of the operating condition of the motor, which may be caused for instance by adjusting the throttle flap 717, also influences the balance beam consisting of the parts 728, 731 and 733.

The above described operation allows a regulation of the correct fuel mixture ratio only as long as the density of the air is not changed. If the specific volume of the air changes, for instance due to a change of temperature, or due to the fact that the aircraft overcomes great differences in height, then these altered conditions must be considered. For this purpose bellows 751 is provided which is arranged in casing 749. From tapping 719 in front of the Venturi tube the state of the air prevailing in front of the Venturi tube is transmitted to casing 749 by way of pipes 726 and 754. Alterations of the state of the air effect an expansion or contraction of box 751 which, by means of rod 748, displaces prism 732 mounted upon surface 747 to the right or to the left, as the case may be. By this displacement the leverage of the regulator balance beam is altered in accordance with the change of the state of the air.

By this arrangement, therefore, a uniform mixing ratio of air and fuel independent upon the output of the motor and the prevailing barometric pressure is always assured.

Now, as is well known, a change of the fuel mixing ratio is desired with a change of the output of the internal combustion engine. This change of the fuel mixture ratio also can be obtained with a device according to the invention, and for this purpose lever 753 is provided. By adjusting lever 753 pivot point 732 of the balance beam is displaced and thereby the fuel mixing ratio is altered.

In Fig. 4 a device is shown which serves to improve the regulation. Pipe 755 leads from nozzle 721 into casing 756 below diaphragm 757. Casing 756 forms part of fuel pump 706. Valve 758 is connected to diaphragm 757. If valve 758 is opened, the fuel fed by geared wheels 759 flows no longer by way of pipe 738 into space 736, but first of all by way of channels 761, 762 back to the other side of geared wheels 759. If the pressure prevailing in box 751 increases, valve 758 is throttled and the feed pressure of the pump is increased.

A particularly suitable modification of the regulating device using control members arranged as a balance beam, will now be described. In this construction an air piston and a fuel piston are provided, the arrangement being such that a relatively small space only is required.

With the regulator according to the invention the fuel mixing ratio may directly be changed at the regulator and, besides, the size of the two piston surfaces may be chosen independent from each other by arranging the two cylinders on a common axis which saves considerably in space. This is effected by providing two springs, one of which may be bent by a piston actuated in dependence upon the effective pressure at the air nozzle, and the other of which may be bent by a piston actuated in dependence upon the effective pressure at the fuel nozzle. The resulting piston forces do no longer directly act upon each other. The problem of bringing the regulator members to an equilibrium again after the regulation has been effected, that is to say the return movement, is effected by the fuel pressure adjusted in accordance with the new effective air pressure.

In Figs. 5 to 9 to embodiments as well as additional details and corresponding regulator diagrams are shown.

For the sake of simplicity, in the embodiment of the invention illustrated in Fig. 5 one cylinder 801 only has been shown of the aircraft engine. Piston 802 reciprocates in cylinder 801 and is connected by means of rod 803 to crank 804 of crankshaft 805. Outlet valve 806 is provided in cylinder 801 which, when opened, connects the cylinder space by way of pipe 807 to the exhaust not shown in the drawings. Inlet valve 808 provided in cylinder 801 effects the admission of the fuel air mixture supplied by pipe 809. By means of flange connection 810 or a suitable gear shaft 811 is connected to crankshaft 805. Shaft 811 carries rotor 812 of a centrifugal blower serving as a charger, spiral casing 813 of which is connected to pipe 809 so that the charger presses the mixture into pipe 809. Air is drawn in by the charger by way of pipe 814 in which air nozzle 815 is provided. Throttle flap 816 is arranged in front of air nozzle 815. Flap 816 may be opened and closed by lever 818 by the intermediary of linkage 817. Tapping 819 is provided in front of nozzle 815, while tapping 820 is arranged directly behind nozzle 815. Tapping 819 is constantly connected by way of pipe 821 to closed space 822 above diaphragm 823, whereas the tapping 820 is connected by way of pipe 825 to closed space 824 arranged below diaphragm 823. The entire circumference of diaphragm 823 is clamped in so that the diaphragm acts as a spring. Rod 826 is connected to diaphragm 823 and attacks slide 827 and thereby displaces slide 827 in dependence upon the effective pressure at the air nozzle 815.

Instead of diaphragm 823 piston 828 shown in Fig. 6 may be used. Piston 828 also adjusts rod 826 and thereby slide 827 in dependence upon the effective pressure at the air nozzle. In this case piston 828 is provided with a second rod 829 which causes bending of spring 830 during the displacement of piston 828. Bearings 831, 832 of spring 830 may be shifted towards the right and towards the left so that by altering the effective length of spring 830 an alteration of the constants of spring 830 may be effected. The purpose of this construction will be described hereinafter.

Slide 827 is provided with openings 833 which allow the fuel to flow from pipe 834 into the interior thereof. Moreover, slide 827 has a control edge 835 by which the fuel pressure is regulated so that the cross section of supply openings 836 is controlled, openings 836 being provided in sleeve 837 surrounding slide 827. The fuel reaching the interior of slide 827 then flows through pipes 838 and 840 to fuel nozzle 839 which e. g. is arranged in the spiral casing of charger 813. Pipe 841 is placed under the pressure of the fuel injected by nozzle 839.

Tapping **842** is provided in the spiral casing of charger **813**. By means of tapping **842** the pressure prevailing behind fuel nozzle **839**, i. e. the counterpressure occurring during injection of the fuel, is transmitted into chamber **844** by way of pipe **843**. Piston **845** is provided above chamber **844** above which in turn chamber **846** is provided. Chamber **846** is connected to pipe **841** by way of intermediate pipe **847**. Pipe **841** carries, as stated above, a pressure coinciding with the fuel pressure prevailing in front of fuel nozzle **839**. Piston **845**, therefore, is subjected to the influence of the pressure difference prevailing in front of and behind fuel nozzle **839**. Rod **846** is attached to piston **845** and is rigidly connected to sleeve **837** surrounding slide **827** so that sleeve **837** is adjusted in accordance with the alteration of the effective pressure at the fuel nozzle. Rod **849** is provided on the side of the piston opposite from rod **848**. Rod **849** bears upon spring **850** and bends the latter more or less in accordance with the position of piston **845** and in dependence upon the displacement of bearings **851**, **852**. In the same manner as resilient diaphragm **823** or spring **830** balances the effective pressure at the air nozzle, spring **850** balances the effective pressure at fuel nozzle **839**.

Fuel is supplied to pipe **834** by means of a fuel pump which in a known manner is constructed as a geared pump **853** having gear wheels **854**, **855** rotating in opposite directions. Pump **853** is supplied with fuel from the fuel tank by way of pipe **856**. Return pipe **857** returns the fuel fed in excess to the suction side of pump **853**. Piston **858** is inserted in return pipe **851**. Piston **858** is influenced on the one hand by the pressure prevailing in pipe **841**, i. e. the pressure in front of the fuel nozzle, and on the other hand is influenced by spring **859**.

Fuel pump **853** feeds fuel under the pressure p_p to throttle point 835/836 where the pressure is reduced to $p_p - \Delta p = \Delta p_D$ that is to say to the pressure prevailing in front of the fuel nozzle. If the pressure of spring **859** is made equal to f, then in the pressure return pipe **857** of fuel pump **853** is equal to $p_p = p_p - \Delta p + f$, and accordingly $\Delta p = f =$ constant which in a well known manner increases the exactness of regulation.

If the resulting force ΔP_1 acts upon diaphragm **823** or upon piston **828** respectively, slide **827** is shifted downwardly about the distance s_1 out of its exit position, i. e. out of that position which corresponds to the effective pressures 0 at the air nozzle and at the fuel nozzle. The throttle openings of the outer slide **837** are just perfectly closed in the exit position by control edge **835** of inner slide **837**. If $tg\alpha_1$ is the spring characteristic of diaphragm **823**, then $\Delta p_1 = tg\alpha_1 . s_1$. If the inner slide has moved downwardly for the distance s_1, then, under the influence of the fuel pressure built up due to the fact that by the movement of the inner slide **827** the fuel throttle has been opened and the fuel pressure acts behind piston **845**, the outer slide **837** moves downwardly for the distance $s_1 - \Delta s_2$, until the throttle opening is again so large that the new fuel pressure corresponding to the new position of slide **837** is balanced by spring **850** having the spring constant $tg\alpha_2$. The mixing ratio λ is represented at this point by the expression

$$\lambda = \frac{G_L}{G_B} = C_1\sqrt{\frac{\Delta p_1}{\Delta P_2}} = C_2\sqrt{\frac{\Delta P_1}{\Delta P_2}} = C_2' \frac{s_1 tg\alpha_1}{(s_1 - \Delta s_2)\, tg\alpha_2}$$

If the effective pressure at diaphragm **823** is increased to ΔP_1 by altering the position of the air throttle **816**, slide **827** is moved about the distance s_1 from its exit position. Under the influence of the effective pressure of the fuel increased by changing the cross section of the throttle, the outer slide **837** follows about the way $s_1' - \Delta s_2'$, $\Delta s_2'$ being greater than $\Delta s_1'$, since now a larger weight of fuel per second is to be throttled about the same value ΔP=constant.

In this case the mixing ratio is:

$$\lambda = C_2\sqrt{\frac{s_1' tg\alpha_1}{(s_1' - \Delta s_2')\, tg\alpha_2}}$$

The mixture, therefore, has become poorer or weaker because $\Delta s_2'$ is greater than $\Delta s_1'$. This non-uniformity may, however, be kept within small limits, as the regulating way, i. e. the amount of relative movement of the two slides, on which this non-uniformity depends is very small.

The above mentioned calculations are diagrammatically shown in Fig. 7.

The non-uniformity mentioned above may also be utilized to compensate deviations from a mixing ratio aimed at. This deviation is due to the compressibility of the air and leads e. g. to an enrichment of the mixture when the measuring is effected by a Venturi tube. By a corresponding formation of the cross section of throttle **836** in an axial direction, the regulating ways, and thereby the non-uniformity of the regulator, may be altered and in this manner the influence of the compressibility of the air may more or less be compensated.

As has already been mentioned above, bearings **851**, **852** of leaf spring **850** are displaceable. For this purpose bearing **851** is fixed to rod **860**, and bearing **852** to rod **861**. Rods **860** and **861** are connected to the ends of rod **862** which may be swung about fixed bolt **863**. The swinging of rod **862** is effected in dependence upon the adjustment of lever **818**, swinging bolt **864** of which may be connected to bolt **863** for instance by shaft **865**.

When lever **818** is shifted, rod **863** is swung and, thereby, the distance of bearings **851**, **852** from each other is altered by means of rods **860**, **861**. Consequently, the free bending length of spring **850** and therefore the constant $tg\alpha_2$ of spring **850** is altered.

If the regulator is to be used for service in great heights with a variable state of the drawn in air, preferably not the diaphragm **823**, but the piston **828** shown in Fig. 6 is used. In this case, bearings **831**, **832** of leaf spring **830** may shiftably be arranged and may be controlled in dependence upon the state of the air (for instance a piston controlled by a measuring box or bellows influenced by the state of the air may effect the displacement of the bearings in a manner, similar to that of the bearings **851**, **852** in such a manner that the constant $tg\alpha_1$ of spring **830** always is adjusted in dependence upon the state of the air.

Fig. 8 shows a modified construction in accordance with the invention, and the same reference characters are used to designate elements shown in Fig. 5. These elements need not be described again. As in the case of the example shown in Fig. 5, the pressure difference at the air nozzle **815** acts upon diaphragm **823** which carries rod **826**. Control piston **866** is attached to rod **826** and cooperates with sleeve **867** surrounding piston **866**. In the same manner as sleeve **837** of Fig. 5 sleeve **867** is connected to rod **848**. Sleeve **867** is influenced by piston **845**. The space below

piston 845 is, by means of pipe 843, placed under the pressure prevailing behind fuel nozzle 839, whereas space 846 above piston 845 is, by means of pipe 868, placed under the pressure of fuel nozzle 839. Sleeve 867 may be displaced in cylinder 869 which, in a known manner, is provided with an inlet pipe 870 and two outlet pipes 871, 872 for pressure oil. In accordance with the position of piston 866 and of sleeve 867 pipes 870, 871, 872 may be connected to pipes 873, 874 which in turn are connected to spaces 875, 876 in front of and behind piston 877, respectively. Piston rod 878 is attached to piston 877 and acts upon piston 858 controlling in the manner described above the quantity of fuel returned to the suction side of fuel pump 853. The pressure side of fuel pump 853 is, by pipe 879, directly connected to fuel nozzle 839.

The operation of this device will now be explained in connection with Fig. 9.

If the pressure P_1 is built up at diaphragm 823, control piston 866 is moved downwardly about the distance s_1. Hereby pressure oil pipe 870 is connected to pipe 873, and pipe 874 disconnected to oil outlet 871. Piston 877 therefore is displaced towards the right and displaces, by way of rod 878 piston 858 towards the right. As only a small amount of the fuel fed by pump 853 is allowed to return by way of pipe 857, the pressure in pipe 879 leading to nozzle 839 is increased. Now, as the difference of the pressures in front of and behind fuel nozzle 839 acts, by way of pipes 843, 868, upon piston 845 the latter together with control sleeve 867 is shifted downwardly against the action of spring 850, until piston 866 and sleeve 867 again occupy their original relative positions and thereby again shut off the supply of pressure oil to servo-motor 877. Consequently, sleeve 867 also must move downwardly about the distance s_1. The following equation results from Fig. 9:

$$\frac{\Delta P_1}{\Delta P_2}=\frac{s_1 tg\alpha_1}{s_1 tg\alpha_2}=\frac{tg\alpha_1}{tg\alpha_2}$$

$$\lambda=C_2\sqrt{\frac{p_1}{P_2}}=C_2\sqrt{\frac{tg\alpha_1}{tg\alpha_2}}=\text{const.}$$

Thus an absolute isodrome-regulation is obtained.

The alteration of the mixing ratio again is effected by altering the spring elasticity constant from $tg\alpha_2$ to $tg\alpha_2'$ e. g. by altering the free bending length of spring 850.

Of course, the influence of the variable state of air may also be considered by an arrangement according to Fig. 6 in exactly the same manner as with the construction shown in Fig. 5.

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BY A. P. C.

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REGULATING INTERNAL COMBUSTION ENGINES

Original Filed Oct. 7, 1938

Serial No.

394,322

4 Sheets-Sheet 1

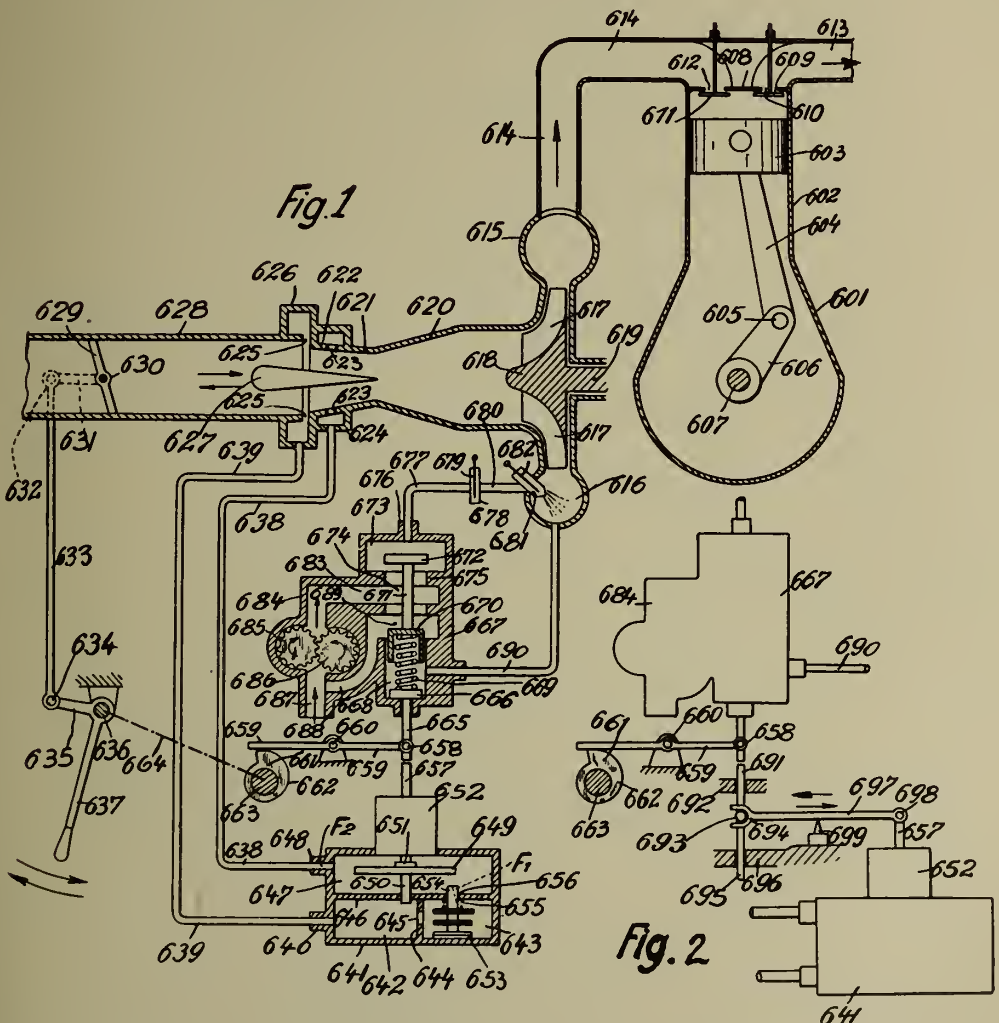

Fig.1

Fig. 2

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Fig. 3

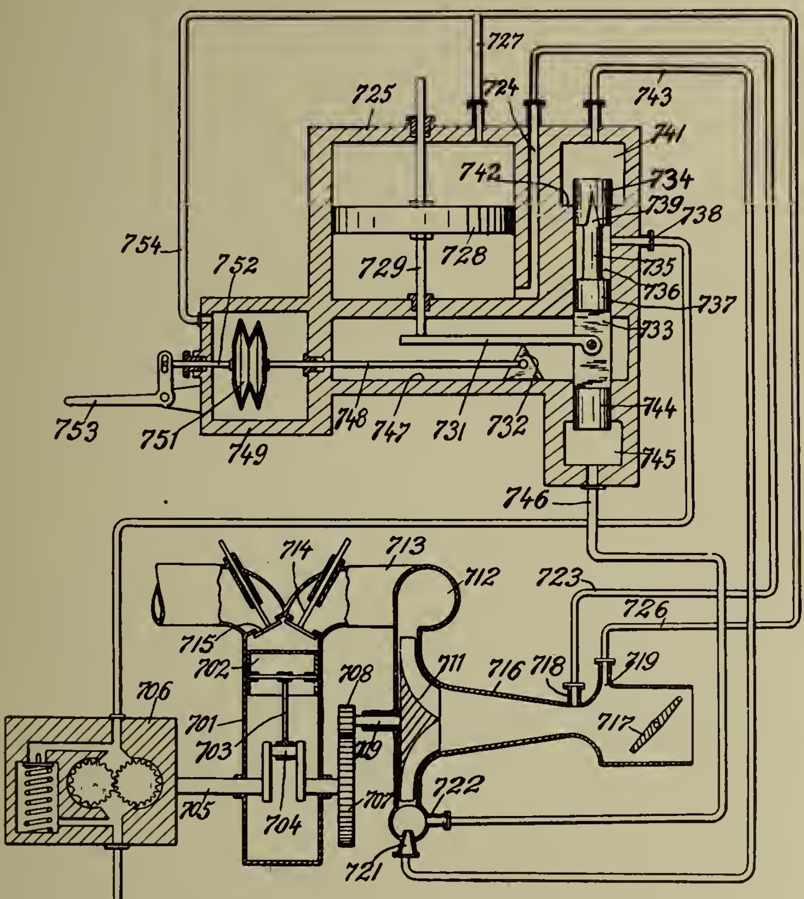
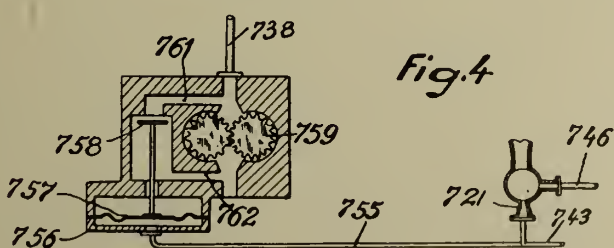


Fig. 4



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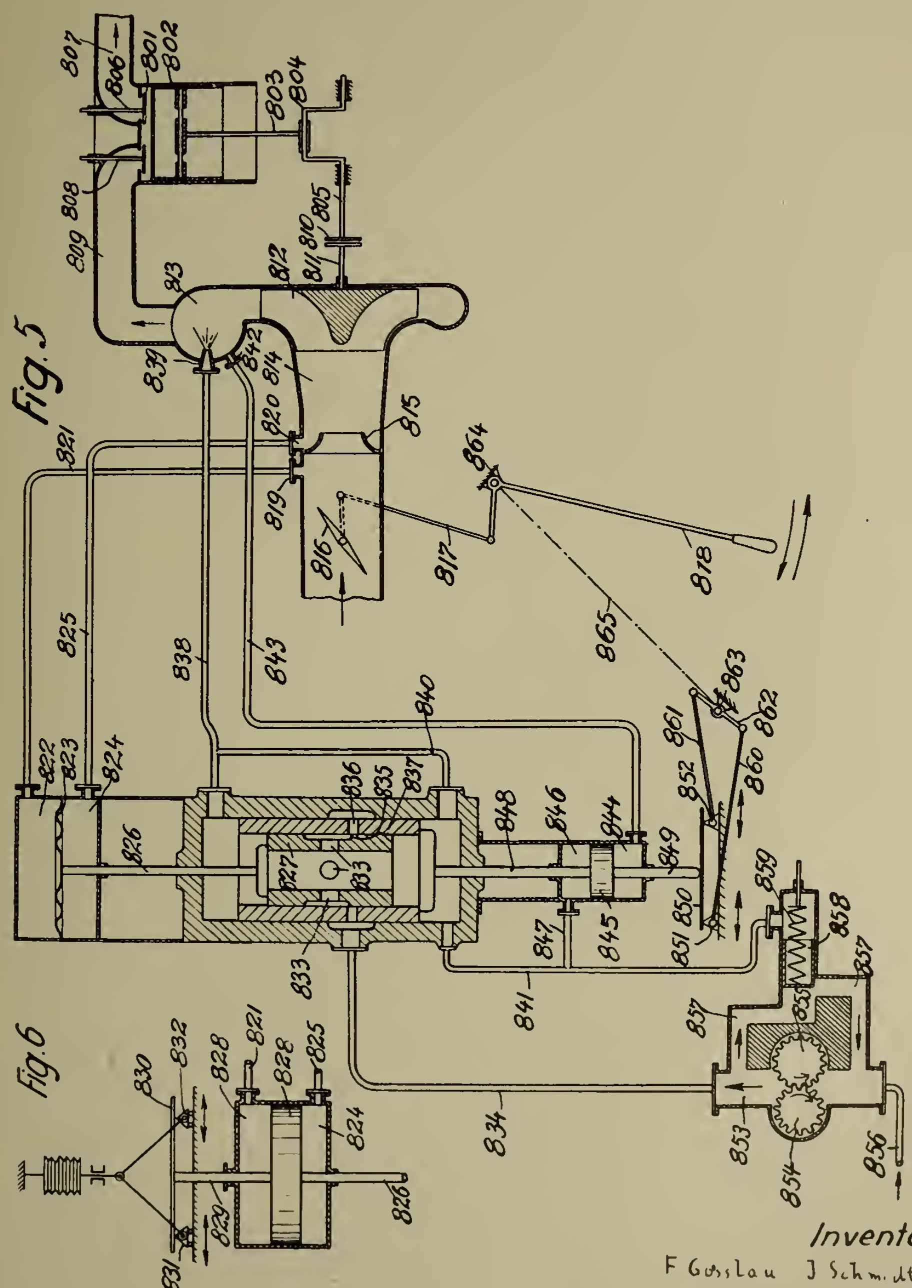

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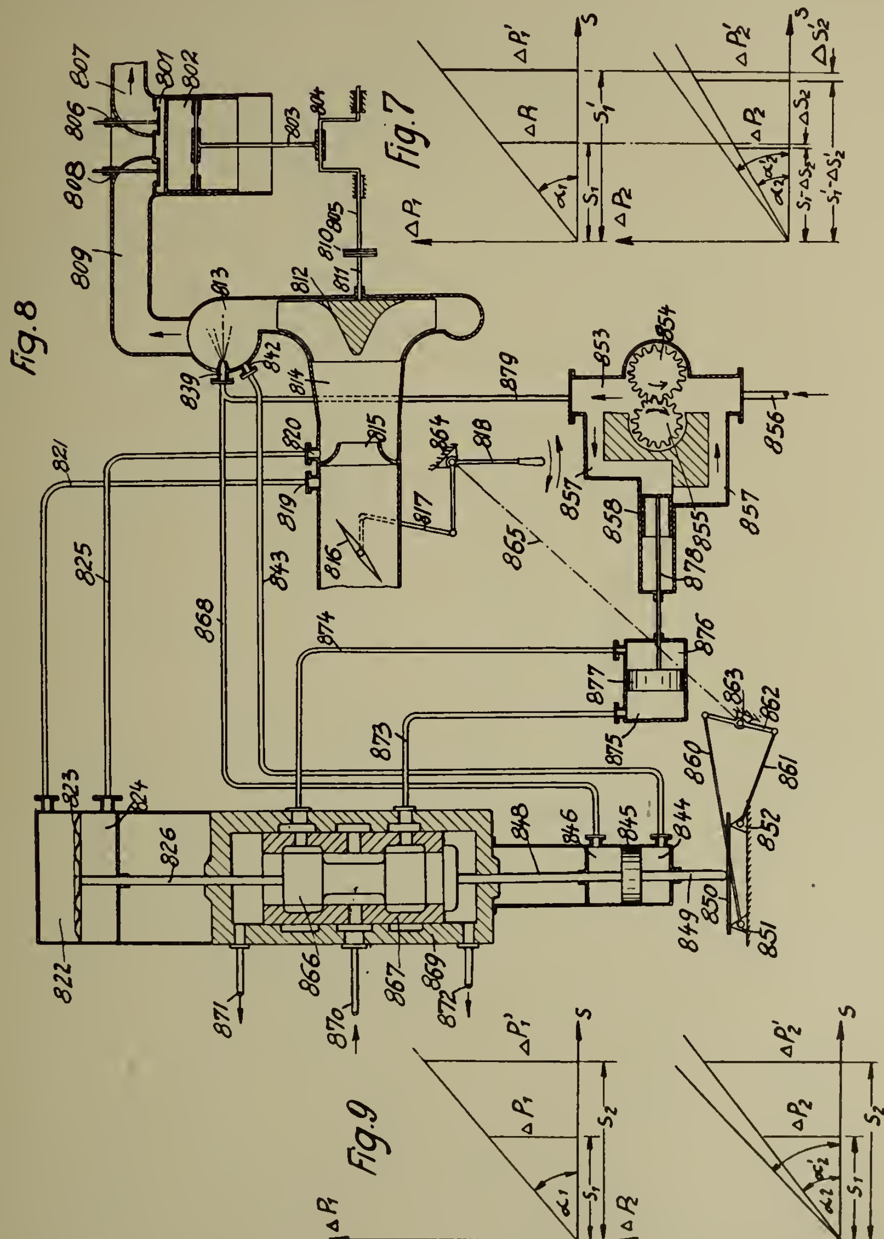

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ALIEN PROPERTY CUSTODIAN

REGULATOR VALVE FOR INTERNAL COMBUSTION ENGINES

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Application filed May 20, 1941

This invention relates to a valve, and more particularly to a regulator valve for internal combustion engines provided with a fuel pump forcing the fuel through the fuel injecting nozzle.

This application is a divisional application based upon certain subject matter contained in our prior copending application Serial No. 233,728, filed October 7, 1938.

In internal combustion engines provided with fuel spray pumps the quantity of fuel to be injected into the cylinders of the engine must be regulated depending upon the power required from the engine as well as in accordance with the quantity of air simultaneously fed to the engine cylinders.

Accordingly, it is an object of the invention to provide a regulator valve for the above purposes which is of very simple construction and which may be actuated with the smallest power consumption.

It is another object of the invention to provide a regulator valve comprising a cylinder and a recessed piston which may be brought to register with a slot in the walls of the cylinder.

It is a further object of the invention to provide a regulator valve which may be actuated with a very small power consumption irrespective of the pressure exercised by the fluid to be regulated.

It is still another object of the invention to provide a regulator valve having a rotatable piston with a recess of a predetermined outline of its control which permits of a particularly simple regulation.

These and other objects will become more evident in the following description taken in connection with the drawing, in which

Fig. 1 is a longitudinal section of a regulator valve,

Fig. 2 is a cross section of the valve taken along the line II—II of Fig. 1.

Fig. 3 is an elevation of a portion of the valve cylinder casing shown in Fig. 1.

Fig. 4 is an elevation of the piston of a modified valve.

Referring more particularly to the drawings, 901 is a cylinder having a threaded cover 902. Piston 903 is inserted into cylinder 901, the piston bearing against the cover 902 by means of a ball pressure bearing 904. Piston rod 905 extends through the cover 902 of the cylinder and may be rotated by means of a lever, 906. Lever 906 may be actuated by hand or the same may be operatively connected to a regulator. This regulator must be so constructed that it rotates lever 906 about the longitudinal axis of piston 903.

The fluid fed by a pump, for instance a geared pump, flows as indicated by the arrows into the cylinder space 907 below the piston 903. Piston 903 is provided with a lateral recess 908 which may be brought into register with a slot 909 provided in the side-wall of the cylinder 901 as shown in Fig. 2. If the piston is rotated as indicated by the arrow 910 (Fig. 2), an increasing quantity of fluid flows through the slot 909 as soon as the control edge 911 of recess 903 surpasses the slot 909. Slot 909 discharges into an overflow channel 912 which returns the fluid to the inlet side of the pump. Below piston 903 a slot 913 is provided in the wall of cylinder 901. The fluid which is not returned through channel 912 is discharged through slot 913.

Instead of the ball pressure bearing 904 any other arrangement may be used which relieves the piston 903 against the fluid pressure, for instance by by-passing a portion of the fluid to the rear side of the piston.

A modification of the control slot arrangement is shown in Fig. 4. Cylinder 901 is provided with a slot 909′ which extends parallel to the longitudinal axis of the cylinder. The recess 908′ of the piston 903 has a control edge 911′ which extends helically under a certain predetermined pitch. This arrangement has the advantage that the curve of the control edge 911′ may be formed in accordance with the regulating law of the engine to be supplied with the fluid. Consequently, for the regulation itself a spring loaded diaphragm regulator, having but one regulator spring, may be used, the regulating characteristic of which, i. e. the regulating way in dependence upon the charging pressure, extends in a straight line, and yet the pump may feed any quantity of fluid in dependence upon the regulating way.

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Fig.1

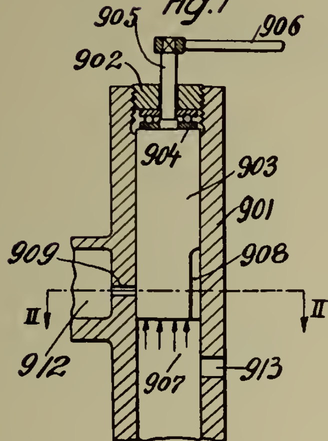


Fig. 3

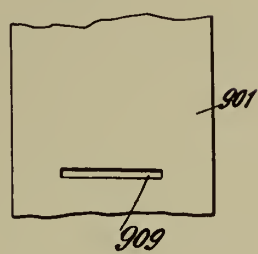


Fig.2

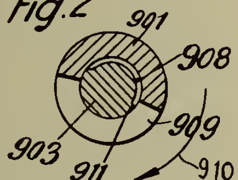


Fig.4

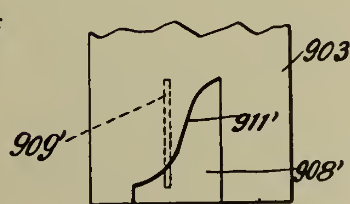
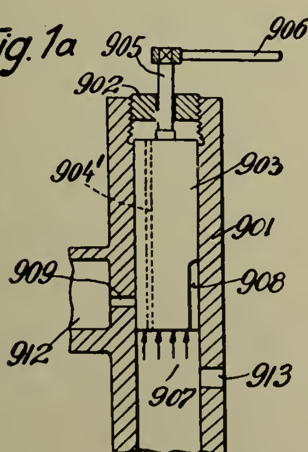


Fig.1a



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ALIEN PROPERTY CUSTODIAN

RECEIVER WITH NEARBY, OR REMOTE MOTOR TUNING AND WITH BAND WIDTH CONTROL

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Application filed May 24, 1941

It is known to tune a receiver by means of a motor in the vicinity of the receiver, or from a remote place, whereby the motor is switched-in for instance by means of push buttons assigned to the various stations and the motor is disconnected again, on receiving the desired position of tuning, by a contact disc which moves simultaneously with the motor and is in connection with the push buttons. The present invention deals with the problem of providing in such a receiver a band width control which operates automatically in dependence on the station which happens to be tuned to.

In accordance with the present invention, after the tuning is completed the tuning motor is automatically coupled from the tuning arrangement to the band width control device by means of a relay which has come to rest by the interrupted motor current so that the elements of the band width control are gradually moved in the sense of a decrease, or increase of the band width until the band width is reached which is determined by the power of the desired transmitter and/or nearby transmitter with the view to reducing the receiving power of nearby transmitters.

In case of a remote operation of the receiver it is already known first to employ the tuning motor for the tuning and then for setting the volume, but the re-coupling and switching of the motor to the second end was done by a switch to be operated at will. In contrast therewith in the present invention the difference is that firstly the tuning motor instead of adjusting the volume, carries out a control of the band width and secondly instead of this performance being carried out by a manual control it is done in a fully automatic fashion after the tuning is completed.

The idea of the present invention is put into practice in that the time period during which the motor acts mechanically upon the control elements of the band width moving them from one limit value in the sense of an increase, or decrease, is determined by the value of the receiving field strength of the transmitter tuned to, i. e. in dependence on the volume control potential or in dependence on the ratio between the field strength of the desired transmitter and that of the neighboring transmitter, or on both values. In the last-mentioned cases the intensity of the 9 kHz local oscillation whistling can be considered as a measure for the said time period. The control of the time of action of the motor on the control of the band width can be obtained through mechanical means by setting a contact disc by means of the band width control potential, as well as with the aid of a time constant organ charged by the control potential. The figures 1 and 2 show an example for the first measure and the figure 3 shows a construction for the second measure.

The arrangement according to Figure 1 operates as follows: The shaft 3 of the motor 2 which is fed from the current source 1 has three bevel gears (7, 8 and 16) so mounted thereon that they can be axially moved, whereby the bevel gears 7, or 8 which are connected with each other serve for the clockwise turning or counter clockwise turning of the tuning means 31. This coupling is effected by the magnet coils M_1, or M_2 which are adapted to pull inwards against the pressure of the springs 10, or 11 the magnetic hollow shaft 4 supporting the bevel gears 7 and 8. The rotational force of the shaft 3 is transmitted to the hollow shaft across a pin which engages in the slot 5 of said hollow shaft. Whether the bevel gear 7 or 8 is coupled with the bevel gear 9 and thus with the tuning means 31 depends on the position which the drub 36 has with respect to the key, or groups of keys 44 having been depressed for the purpose of tuning. The surface of the drum is divided into two conducting surface parts in a manner known as such and which are electrically separated by an insulating strip 37 extending obliquely to the shaft, whereby the one surface part is connected to an end of the coil M_1 while the other part is conductively connected to an end of the coil M_2. In the position of the switch herein shown, the contact next to the bottom contact is depressed whereby the magnet coil M_2 is switched-in which forces the bevel gear 7 against the bevel gear 9 thus turning the drum until the depressed contact on reaching the insulating strip interrupts the circuit. This circuit extends from the motor 2 along the line 39 across M_1, or M_2 to the drum 36 from there through the contact group 44, across the line 35, to a further magnet coil M_4 whose purpose will be described below, and from there across the line 34 to a further magnet coil M_5 which pertains to a relay. From there the current returns to the current source 1 through the lines 33 and 32.

After the tuning is completed among other things also the relay coil M_5 which falls off with delay has no longer current. Thus the line 43 will be connected with the line 42 and the motor will be switched in again. However, since the coils M_1 and M_2 receive no current while the bevel gear 9 takes up the position in the center between the bevel gears 7 and 8, the tuning will

in no ways be affected. Now the current passes from the motor across the lines 39 and 40 to the magnet coil M_3 which draws in the armature joined with the bevel gear 16, thus coupling the bevel gear 16 with a larger bevel gear 17 which turns about the shaft 19 supported in the bearings 18. From the magnet coil M_3 the current then passes across the line 41, the disc 27 with the aid of the contact 23 gliding on said disc, then across the shaft 25 to the line 42, 43, 32 and thence to the current source 1.

The magnet coil M_6 which tends to pull an armature 30 into itself is energized by the plate current, or cathode current of the control tubes which current is to determine the time during which the motor is to turn for the control of the band width. The armature 30 has a cord 29 fastened thereto which is several times wound about the shaft 28 of the said disc 27 and which is tensioned by a spring 15. The disc 27 carries on its circumference a conductive ring which is interrupted by a grooved place 46 (Figure 2) of insulating material. The position of said grooved place 46 shown in Figure 2 is assumed at receiving a local station where the current passing through the coil M_6 has a minimum value. When tuning to a more distant station, the current increases, the armature 30 will be attracted and the disc 27 turns in the direction of the arrow shown in Figure 2. The grooved place 46 assumes hereby for instance the position 46', or the position 46'' in case of a still weaker station. This signifies that the circuit is closed by means of the contact glider 23 and that therefore the disc 17 will be driven. Consequently, the cord 20 tensioned by a spring 14 and wound around a wheel 21 will be unwound, thereby turning the wheel 21 and at the same time the device for controlling the band width but which is not shown in the drawing.

This wheel 21 is coupled through the shaft 25 with the disc 22 on which the contact 23 is conductively mounted. Furthermore, a magnet armature 26 is mounted on the shaft 25 and which can be drawn into the magnet coil M_4. As long as M_4 is without current, i. e. during the control of the band width and thereafter, the spring 13 forces itself against the armature 26 and thereby against the shaft 25 with the effect that the disc 22 is pressed against the fixed disc 24. By providing sufficient roughness of the surfaces of 22 and 24 which face each other (for instance rubber layer) the brake force is increased to such an extent that on the one hand, it will not be overcome by the downward pull of the springs 14 which are more or less tensioned in the course of the control, and that on the other hand, a turning of the disc 22 by means of the motor 1 in the opposite direction will be possible.

The pulled, or rotary parts of the elements for the control of the band width are connected with the wheel 21, or with the disc 22, or with the part of the cord 20 residing between the spring 14 and the wheel 21. For instance, a pulling rod connected with the coupling coils of the band filters and actuating the latter, can be so connected with the point 47 that the further the said point moves in the direction towards the wheel 21, the narrower becomes the band width. Meantime also the disc 22 turns and therewith the contact 23 in the clockwise sense (Figure 2) and the more so the further the groove 46 has moved likewise in the clockwise direction. Thus the band width will reduce its width the more, the weaker the station tuned to. If the contact arrives in the notch, the circuit will be interrupted and the elements of the band width control remain in the assumed position. On account of the arrested contact also the disc 27 remains in position despite eventual variations in the control performance.

Now if by depressing another push button another station is tuned to, then by means of the relay M_5 also at this place the circuit effective for the control of the band width will be interrupted and at the same time the attracted armature 26 of the magnet M_4 removes somewhat the disc 22 including the contact 23 from the disc 24 so that the spring 14 can set the elements of the band width control into the initial position, i. e. to maximum band width in the present example of construction. Obviously, through a slight modification of the arrangement the latter can be so adapted that the narrowest band width serves as initial position (in the example of construction described at the end of the description—this bringing back into the initial position is not required).

In the present example it is not advisable to insert a friction coupling between the disc 17 and its shaft in order to avoid that the cord 20 will eventually be tensioned too much.

The arrangement according to Figure 3 is to a large extent identical with the arrangement shown in Figure 1. However, the arrangement is shown at the moment in which the tuning is completed and the control of the band width takes place. As in the case of Figure 1, the tuning circuit is closed across the magnet coil M_4 and relay M_5. In the arrangement the shaft 25 has no longer the disc 22 and contact bar 23 and furthermore the device shown separately in Figure 2 is no longer present. Just as in the case of Figure 1, the elements for the band width control are driven by the wheel 21, or cord drive 20 (point 47).

As regards the tuning circuit there exists in the circuit of Figure 3 as compared with that of Figure 1 the sole difference that the relay coil M_5 instead of pertaining to a switch-off relay, belongs to a reversing relay. There is however an essential difference as regards the effective circuit for the band width control. On reaching the proper tuning position the release of the armature from the relay M_5 effects the closing of the circuit for the band width control across the lines 49, 48 and 41 and across the contact of the relay M_6 at the right bottom of the figure. The magnet M_3 effects in the manner already described, the coupling of the bevel gear 16 with the bevel gear 17.

The time during which the motor acts upon the elements of the band width control is determined by the duration of the discharge of the condenser 57 across the resistor 56, namely as follows: The tube 51 represents a controlled high frequency tube, or intermediate frequency tube of the receiver whose grid circuit has at arrow 52 the volume control potential applied thereto in the customary manner. The end of the cathode resistance of this tube which faces away from the cathode is placed at ground, or at the mass. Between this point and the minus pole of the line section designated by 53 a resistance 55 is inserted which is passed by the cathode current of the tube 51, or by the sum of the cathode currents of all controlled tubes. In order to prevent the plate current of the non-controlled tube (oscillator stage, or end stage for instance) from passing likewise across the resistance 55, the

cathode resistances of said non-controlled tube are placed directly at the minus pole A. By means of a parallel condenser for the resistance 55 but which is not shown in the drawing this resistance is bridged as regards high frequency and audio-frequency.

The direct potential appearing at the resistance 55 is higher, the lower the field strength of the station tuned to. Since in the state of rest of the drive device this potential has its negative pole placed at the grid of the auxiliary tube 54 across the lines 50, the said tube is blocked and no current passes through the relay M_6. Now, through the release of the armature of the relay M_5 at the start of the control of the band width, the lines 50 are separated, the condenser 57 will be discharged across the high-ohmic resistance 56 and a strong plate current begins to flow in the auxiliary tube 54 after a certain time period which depends on the value of the initial potential at the condenser 57 as well as on the dimensions of the condenser 57 and of the resistance 56 whereby said current terminates, by means of the relay M_6 through the falling-off of the relay M_5, the setting operation of the band width in the position shown. In this circuit the plate potential and therewith the value of the plate current which flows at the de-blocked state of the auxiliary tube 54 will be set by the resistances 58 and 59.

The following dimensions for the R—C member are given by way of example: Condenser $57 = 1\mu F$, resistance 56=3 megohm.

Moreover sufficient time must be available in order that on reaching the correct tuning position the condenser 57 can charge itself across the lines 50 to the potential value corresponding with the received station. Thus, when the proper tuning position is reached the relay M_5 shall not open the circuit 50 instantaneously, but instead with a certain delay such as for instance 0.3 to 0.5 sec.

In the case of motor tuning it is customary to disconnect in some way parts of the receiver so as to render inaudible the frequencies existing between the station last tuned to and the station being tuned to. Also in the case of the control device according to the present invention the same measure will preferably be resorted to and the reproducing organ switched-in after the tuning is completed. It will however, be unnecessary to wait with the switching-in of the reproducing apparatus until the control of the band width is completed, because this control does not disturb the reception.

The present invention affords the control of the band width in all high frequency and intermediate frequency stages since through the motor a sufficient driving power and setting power is available.

Simultaneously with the setting of the band width a control of the receiving power can be carried out in that on receiving powerful stations a small fraction of the antenna potential arrives at the control grid of the first tube as compared with the reception of weaker stations. In this way it is accomplished that an excessive control of the first tube and thus a source of distortions then no longer unavoidable, is entirely eliminated. For this control there may be employed for instance a variable inductive coupling, or an ohmic resistance, or a capacitive rotary voltage divider. This control element is required to respond only in the range of especially high field strengths, while leaving the coupling of the antenna constant below a certain limit value of the field strength, namely at values where the danger of excessive control no longer exists. On the other hand, an influencing extending throughout the entire range of the field intensity affords the advantage of an additional balancing of the volume.

In the examples of construction described above, it was presupposed that the motor can turn the elements of the band width control in a single direction only such that during the tuning performance for another station the elements of the band width control must always be returned again into the initial position. This bringing back becomes superfluous if the contact disc 27 in Figure 1 which is moved by the band width control potential into the position corresponding with the desired station, is divided at two insulated places into two parts as in the case of the contact drum 36 whereby each of the said parts is placed in series with a respective coupling magnet for different drive devices for the elements of the band width control. In this case the coupling magnet M_3 in Figure 1 is replaced by two magnets which effect as in the case of the magnets M_1 and M_2 a reversing of the direction of rotation of the disc 17 and thus a reversing of the movement of the elements of the band width control. The input terminals of the two magnets serving for this purpose are then connected, together with the line 40 and the output terminals, with the two parts of the split insulating disc 27 across respective lines (instead of across the line 41). The disc 22 is then fixedly coupled with the disc 17, for instance by employing a common shaft, and the following parts will be omitted: 13, M_4, 26, 14, 21, 20 and 24.

HEINZ BOUCKE.

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MAY 25, 1943.

BY A. P. C.

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RECEIVER WITH NEARBY, OR REMOTE MOTOR TUNING AND WITH BAND WIDTH CONTROL

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2 Sheets-Sheet 1

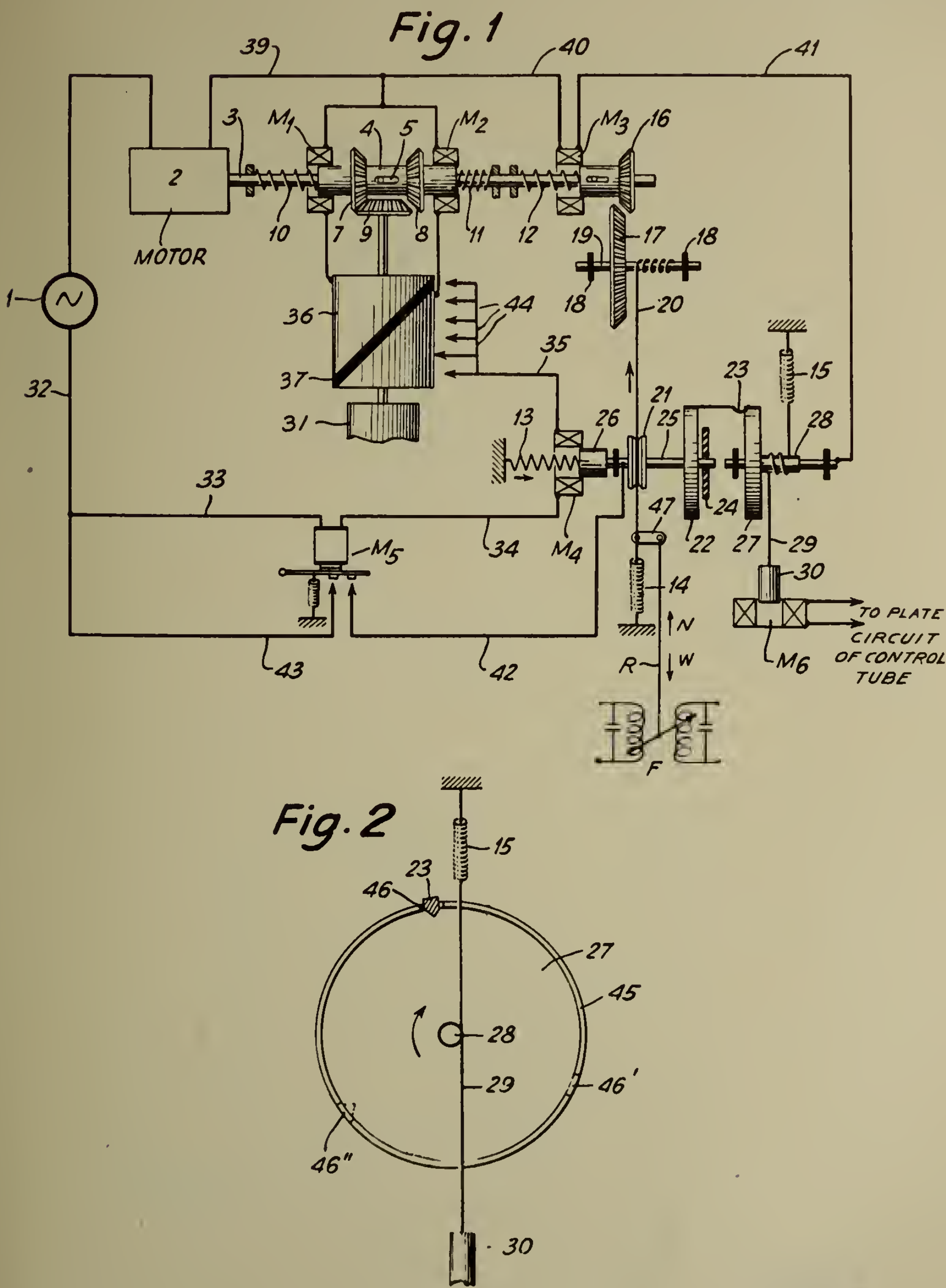

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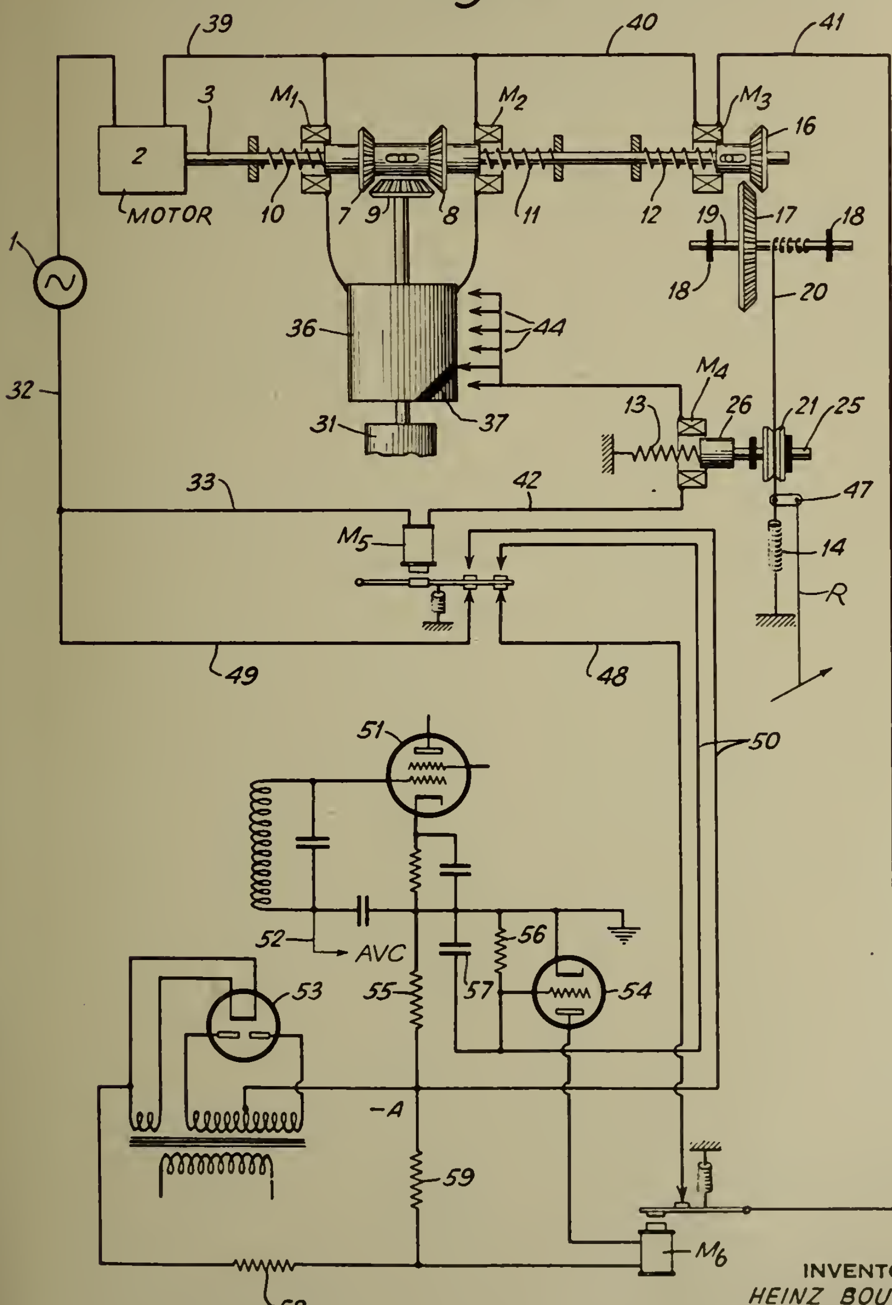
Fig. 3



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ALIEN PROPERTY CUSTODIAN

HIGH TENSION APPARATUS

Kurt Bischoff, Erlangen, Germany; vested in the Alien Property Custodian

Application filed May 24, 1941

This invention relates to high tension apparatus, and is particularly concerned with arrangements or apparatus wherein an electrical discharge tube or a Roentgen tube is provided in a common housing or container together with a high tension generator.

The insulation of the windings and apparatus parts which are in such apparatus subjected to the high tension against ground causes considerable difficulties. The weight of such structures should be kept as small as possible, and this requirement increases the insulating difficulties very considerably.

In order to avoid these and other difficulties, a suggestion was made which, theoretically, appears to be correct, the realization of which is, however, extraordinarily difficult, particularly in the case of apparatus for very high tensions, (for example, tensions exceeding approximately 200,000 volts). This known suggestion is concerned with an apparatus including an electrical discharge tube built together with a high tension generator and having only a single high tension coil. The insulating layers arranged between the individual winding layers of this coil extend beyond the edge so that, upon cutting into the overlapping edges at uniform intervals, insulating flags or flaps are produced in radially extending layers, which are then lapped or folded over, for example, toward the middle of the outer side of the coil. The folding-over of these insulating flaps avoids flash-overs at the side walls of the coil. Built into the insulation at one point of the circumference of the coil is an electrical discharge tube which is subdivided into individual stages. In addition, a plurality of metallic potential control surfaces may be embedded in the folded insulating layers for the purpose of controlling the potential. These surfaces also control the potential along the discharge tube.

It should be assumed, from the point of view of insulating technique, that this suggestion would lead to a satisfactory solution of the insulating problem in the building of such apparatus. The production of structures according to this suggestion is, however, made unusually difficult and complicated in view of the fact that the high tension winding consists of a single coil, and that unequally wide insulating layers must be built into the structure during the winding of the coil. Particular difficulties are caused by the requirement that the metallic potential control surfaces must not act in the manner of shunt windings for the high tension transformer and that they must be approximated everywhere to the shape of the insulating body. It must also be considered that the structure of such a single coil high tension winding must not exceed a predetermined width in order to avoid an unfavorably high layer potential. The coil for very high tensions (about 1 million volts) must, therefore, be highly wound in order to accommodate the required number of turns, and this leads to an unfavorable condition regarding the straying which in turn affects the efficiency of the generator.

In accordance with the present invention, the building of such high tension apparatus is made easier, simpler, more economical and also more efficient by producing the high tension in a plurality of coils assembled or bandaged together; that is, the high tension is produced in individual windings (the insulation being in the manner of a bandage and one continuous bandage including all coils lying on a higher potential against ground, or rather including the individual windings of the high tension generator together with the connecting conductors up to a point of the tube housing or to a high tension conduit), each of these bandages which are successively attached being provided throughout with a conducting layer for the purpose of a complete potential control, thereby obtaining at every point approximately the same electrical load of the insulating material, and this conductive layer being connected with the lowest potential of the high tension generator which is included in the individual bandages.

The insulation of the individual coils, that is to say, the individual coils against ground, is at all points continuous by this introduction of the metallic layers extending over the entire surface of the individual bandages and being connected with the windings of the high tension coil, and the insulation is thus permeated by the conductive equipotential surfaces, the potential of which is controlled directly by the high tension generator up to the place where the high tension pole is conducted from the apparatus. The electrical load of the insulating material is in this manner accurately predetermined at all points. A minimum of insulating material will thus suffice, and material as well as space is saved without producing any undue stress that would go beyond the electrical value the material can stand.

The potential distribution within the insulation would be entirely different if the potential control surfaces would be omitted, assuming of course identical arrangement and strength of the individual bandages. The field strength would

increase very considerably from the outside to the inside according to the curvature of the surface elements which are to be insulated against ground. In the different parts of the high tension generator, as well as its connecting lines leading to a heating transformer and a tube housing that may be provided, we must consider entirely different radii of the curves. Therefore, the equipotential surfaces within the insulating bandages do not everywhere conform to the individual paper layers.

The production of the new high tension generator is considerably simpler than that of a single-coil high tension generator made in accordance with the previously mentioned prior suggestion. The winding parts which are individually made and individually bandaged, as well as the common bandaging of these parts, does not cause any difficulties. The metallic potential control surfaces can be produced, for example, by using for the uppermost layer of the insulating bandage a paper strip which is metallized on one side, or by using a thin metal foil which is introduced into the bandage, whereby short circuit windings through the metal layer are avoided. The control surfaces can also be formed by spraying the individual bandages with suitable metal whereby, in order to avoid short circuit windings, a strip-like surface piece is held free at the circumference of the coil, and this piece is provided with a thin intermediate insulating layer and is also covered with a metallic layer which is conductively connected with the first noted metallic layer.

The invention is schematically shown in the accompanying drawings, wherein

Figs. 1 and 2 illustrate two embodiments, partially in section and partially in plan view, of structures for producing very high tensions, and particularly of high tension generators built together with discharge tubes or Roentgen tubes.

In the embodiment shown in Fig. 1, the high tension generator consists of two transformers with iron cores **3** and **4**. It is accommodated together with the two-stage Roentgen tube **1** in a common container **2**. Each of these transformers has two primary windings **5** separated from each other and two secondary windings **6**. The secondary windings again may consist of a plurality of coils each bandaged for itself. As shown in Fig. 1, the four secondary windings **6**, which lie on a higher potential against ground, are bandaged together in such a manner that always one contiguous bandage **7** includes all individual windings **6** of the high tension generator together with their connecting lines **8**. Each of these bandages **7**, in accordance with the invention, is provided throughout with a conducting layer **9** which is connected at the corresponding points with the lowest potential of the parts of the high tension transformer that is embedded in the individual bandages. In the case of a total tension of the generator, which is grounded at one side, of, for example, 500 kV, the individual control surfaces **9** therefore receive the potential 0.125, 250 and 375 kV.

In accordance with another feature of the invention, the heating transformer **10** provided for the heating of the Roentgen tube **1** can be covered throughout in the same manner with the conductive control surfaces **9**.

The Roentgen tube **1** is built into the stepped bandage of the high tension line **11** in such a manner that its cathode side **12** is in connection therewith. The insulating bandages **7** and the control surfaces **9** terminate, as viewed from the cathode side of the Roentgen tube, from the inside to the outside in a stepped or staggered manner, and the control surfaces **9** thus serve for controlling the potential of the Roentgen tube.

In case the high tension should be conducted not to a Roentgen tube, which is provided with the generator in a common container, but, for example, to an apparatus outside of the container, the insulating bandages **7** and the control surfaces **9** may end or terminate in corresponding manner in a high tension conduit.

Another example of the invention is shown in Fig. 2. The high tension is produced in a winding which is subdivided into several parts **13**. We have again shown this second embodiment for the sake of simplicity in connection with a high tension generator which is grounded on one side. The arrangement of the bandages **7** and the control surfaces **9** is here very similar to that in the first example. By the use of a single winding consisting of four part windings **13**, which is arranged together with the primary winding **14**, upon the iron core **15**, the building of the entire structure is considerably simplified and made more accessible, and weight as well as space can be saved as compared with the embodiment discussed in connection with the first example.

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2 Sheets-Sheet 1

Fig.1

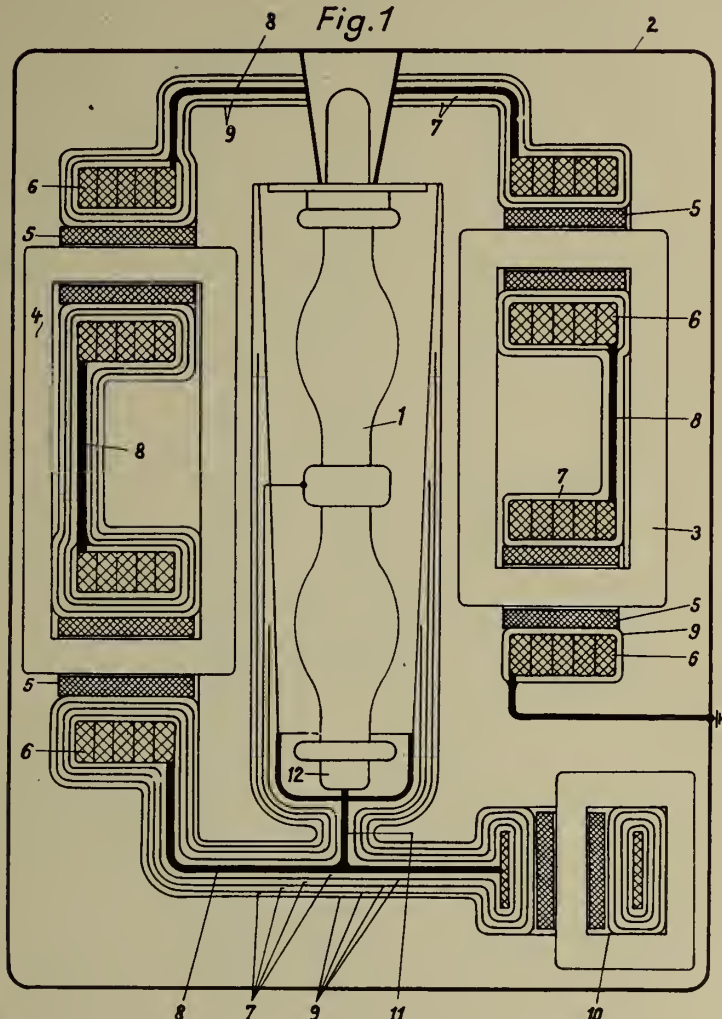

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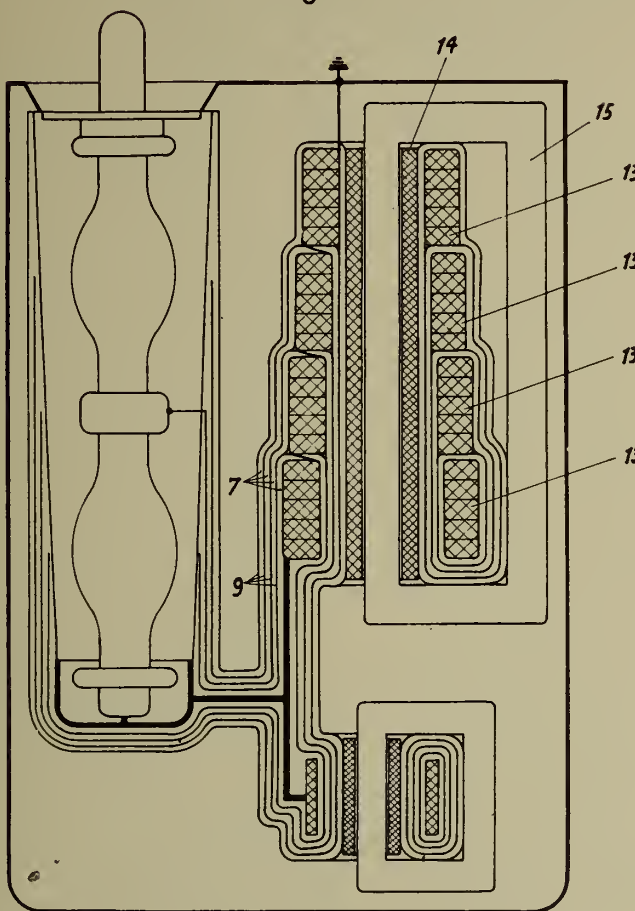
Fig. 2



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ALIEN PROPERTY CUSTODIAN

DIALYZING DIAPHRAGM

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No Drawing. Application filed May 29, 1941

Our present invention relates to dialyzing diaphragms and more particularly to diaphragms produced from polymerized substances.

It is known to use cotton fabric impregnated with inorganic substances, if desired, for dialyzing caustic soda solutions or other alkaline liquids injuring the resistance of the cellulose fibers.

There are large dialyzing surfaces in the dialyzing apparatus "system Cerini," "system Heibig," and "system van Barnefeld" which are employed to a large extent. Since cellulose diaphragms are rapidly attacked by strong alkaline solutions so that they soon are unable to withstand even slight mechanical vibrations and other similar influences it is necessary very often to renew the diaphragms. It is also of disadvantage that the replacement of the diaphragms yields a considerable loss of time especially as they must be exchanged by hand.

It is an object of the present invention to obviate the disadvantages mentioned above.

Another object is the provision of improved dialyzing diaphragms prepared from fabric or the like of polymeric hydrocarbons.

A further object is to provide improved diaphragms made of polymerized vinylchloride.

Other objects of our invention will be apparent from the following description:

The present invention is based on the observation that a fabric, felt or paper from filaments or fibers produced from polymeric hydrocarbons or the derivatives thereof containing chlorine or from mixed polymerizates containing such polymeric components as hitherto proposed for filtration is also suited to be worked up into appropriate dialyzing diaphragms for alkaline liquids when, after swelling if desired, the fabric or the like is impregnated with metal compounds capable of producing thereon a semipermeable diaphragm insoluble in aqueous alkaline liquids.

All inorganic compounds which are usually employed in the production of dialyzing diaphragms for alkaline liquids, for instance, metal compounds forming hydroxides insoluble in aqueous alkaline liquids such as salts of earth metals and alkaline-earth metals (see German Patent No. 571,702) may be used for the purposes of the present invention. It is quite surprising that in spite of the low capacity of swelling in aqueous liquid of the filaments prepared from these highly polymerized substances the coat consisting of the semi-permeable diaphragm so strongly adheres that the technical application thereof is possible. The inorganic salts are especially intensely absorbed if the fabric or the like is presoaked with an organic liquid capable of dissolving it and subsequently treated with the metal salt solution. It is without difficulty to adjust the capacity of soaking of the organic liquids to a desired degree. To the organic liquids able to dissolve the polymerization products there are added non-solvents in such an amount that the fabric only swells and the mixture of the liquids is not capable of dissolving it wholly or partly. As solvents liquids or mixtures thereof miscible with water are conveniently used and water is preferred to serve as the non-solvent. The mixing portion of solvents and non-solvents varies with the thickness and the strength of the fabric. The period of action necessary for sufficiently swelling is 30 minutes to 1 hour in general. Liquids having a low capacity of soaking, however, may also act on the fabric for an essentially longer time, for instance 24 hours and more without effecting a detrimental transformation thereof. Furthermore, the shrinking is dependent on the temperature so that, for instance it is possible to employ a mixture having a relatively low percentage of solvents at a high swelling temperature. Instead of the mixture of a solvent and a non-solvent there may also be used a single liquid substance capable of soaking the fabric without dissolving, as for instance, benzine or benzene. Since an addition to the swelling liquids of salts increases the effect of swelling, it is often advantageous to dissolve the inorganic salts necessary for forming the semipermeable layer in the swelling liquid and cause this solution to act upon the fabric. The impregnation with the inorganic salt solution, however, may also be carried out subsequently to the swelling treatment. Especially suitable soaking liquids are, for instance, aqueous solutions of acetone, tetrahydrofuran, glycolformal or methylglycolformal.

The semipermeable coats may, for instance, be produced in the following way:

A fabric prepared from polymerized vinylchloride and consisting of 16 warp filaments, denier 1180 and 12 weft filaments, denier 1186 for cm² is treated with an aqueous acetone solution of 30% strength, containing 15% of magnesium chloride (or 15% of calcium chloride, barium chloride or aluminum chloride) at 20° C. for 1 hour. The fabric is subsequently freed from the liquid by slightly pressing and dried. Finally the fabric is treated with an aqueous caustic soda solution of 17% strength. After the sodium chloride thus formed has been removed from the fabric by

washing with water the desired dialyzing diaphragm is ready for use.

A dialyzing diaphragm thus produced has the same dialyzing effect as the cotton fabrics used heretofore but it is nearly unlimitedly durable even if the diaphragm is dried after each employment. Accordingly, the process of the invention also has important economical advantages.

The step of soaking the fabric or the like with liquids may also be replaced by a heating treatment which results in shrinking but the semipermeable layer produced on a shrinked material less strongly adheres thereto than to a material swollen by a liquid. Moreover the permeability of polymer diaphragms having a large surface cannot be adjusted by heat shrinking in so a convenient manner as is possible by soaking with liquids.

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METHOD OF PREVENTING NATURAL COMBUSTION AND OVERHEATING OF SULPHIDE ORES AND OTHER MINERAL PRODUCTS

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No Drawing. Application filed May 29, 1941

My invention relates to a method of preventing harmful natural heat generation of sulphide ores or other mineral products which are liable to cause spontaneous combustion, and its object is to safely prevent the natural firing or overheating of mineral ores or products such as particles obtained by a flotation method during their storage or transportation.

Fine powders of sulphides of metals such as copper, iron, lead, zinc and the like are unavoidably oxidized by the action of moisture contained in themselves and air during a long storage or a huge accumulation as in case of shipping or marine transportation. Especially in case of loading of a large quantity or a great deposited mass of fine powders such as flotation products, the heat transmission or ventilation is not good so that the heat caused by oxidation may be accumulated owing to the small specific heat of the fine powders and the evolution of heat proceeds with acceleration resulting often spontaneous firing.

My invention is to prevent the dangerous heat evolution of the mineral products by suppressing the natural oxidation of sulphides of metals which is the main cause of the heat generation. For this purpose, I have found out after many experiments that soap solution is most effective for preventing the progress of natural oxidation of sulphides. In accordance with my invention, soap solution or soap in other form is sprayed or mixed with powders of mineral ore or treated products, or blown refuses of metallurgical refining process, or other mining products which are liable to cause the spontaneous heat evolution. Then the soap solution reacts with the sulphates of iron, copper, aluminium, calcium or other metals, which coexist with or are attached to the particles of ore or the mineral products, as the result of oxidation of the surface of sulphides and produces insoluble metallic salts of fatty acids which form protective covering for the other ores and sulphide particles, thereby suppressing the natural oxidation caused by the combined action of moisture and air, and thus the heat evolution can be prevented.

In carrying my invention into effect, any kind of alkaline soap may be used and a suitable amount such for instance as 0.1 to 3% of soap such as soda soap may be dissolved in water. Such soap solution is sprayed on fine particles of copper ore collected as flotation products or concentrate containing copper pyrite and iron pyrite, for instance, when such flotation products or ore particles are shipped on board for the purpose of transportation. Fine powders or paste of soap may be mixed with sulphide particles by suitable means. Then the danger of heat evolution due to the spontaneous combustion even during a long voyage can be safely prevented by the action of protective film of insoluble fatty acid salts produced by the chemical reaction of soap and sulphates of metals, thereby covering the ore particles to isolate the particle from air and water and to suppress the oxidation of sulphides.

The inventor considers that natural combustion of coal is caused by the effect of sulphide particles attached to coal and accordingly the present invention can equally be applied to coal or coal particles for preventing spontaneous combustion or explosion.

Alkaline elements in the soap have no effect of preventing natural oxidation of sulphides, but the action of fatty acids in soap is utilized by this invention. According to my experiments I have ascertained that mere alkaline solution such as lime solution is not effective to prevent the natural oxidation of coal since the oxidation of sulphides such as iron pyrite occurs according to the following reaction:

$$FeS_2+7O+H_2O \rightarrow FeSO_4+H_2SO_4$$

The sulphate base "SO_4" in the right term of the equation is neutralized by alkali such as calcium hydroxide successively so that the equilibrium is not stable and the oxidation proceeds constantly. Thus it will be clear that the action of fatty acids in soap upon sulphates is most important in this invention.

KATSUYUKI HIKAMI.

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ALIEN PROPERTY CUSTODIAN

AIRCRAFTS

Paul Aimé Richard, Clichy, France; vested in the Alien Property Custodian

Application filed June 3, 1941

The present invention relates to aircrafts.

The object of the invention is to provide an aircraft which is better adapted to meet the requirements of practice than those made up to the present time.

According to an essential feature of the invention, the aircraft is provided with motor means for propelling it adapted to suck in a mass of air constituted at least partly by the air driven along by the airplane in its movement and to discharge said air through a nozzle directed rearwardly with respect to the aircraft.

Other features of the present invention will result from the following detailed description of some specific embodiments thereof.

Preferred embodiments of the present invention will be hereinafter described with reference to the accompanying drawings, given merely by way of example, and in which:

Fig. 1 is a diagrammatical plan view, with some portions cut away, of an airplane made according to an embodiment of the invention;

Fig. 2 is a vertical sectional view corresponding to Fig. 1;

Fig. 3 is a diagrammatic section of a wing of an airplane according to the invention;

Fig. 4 is a view similar to Fig. 3;

Fig. 5 shows a modification of such a section;

Figs. 6 and 7 are similar views corresponding

The following detailed description will relate to the construction of an airplane according to the invention.

The general structure of this airplane is made of any suitable form, for instance that, illustrated by the drawings, corresponding to a monoplane including a fuselage **1** and a wing **2**.

I dispose, for instance, on the inside of this fuselage, at least one engine **3**, driving a shaft extending in the rearward direction and carrying a system of inner airscrews or the like **4** which act as a compressor system and are located in a tunnel **5**.

This system of airscrews may be of any kind and constituted, for instance, by a plurality of elements some of which are driven by engine **3** in a direction opposed to the direction of rotation of the others.

The suction end of tunnel **5** is connected to inlet orifices provided along the wing or fuselage, in such manner that the air that is sucked in is, at least mostly, constituted by air driven along by the forward motion of the airplane, that is to say air which is substantially stationary with respect to the airplane.

On the other hand, I connect the discharge end of said tunnel **5** to at at least one nozzle **6**, directed rearwardly with respect to the airplane. Thus the air compressed in the system of airscrews **4** is discharged into the atmosphere after having expanded in said nozzle. Preferably, this expansion is carried out in thus manner that the velocity of the air leaving the nozzle is zero, that is to say said air is ejected from the nozzle with a relative velocity equal to the translation motion of the airplane with respect to the surrounding atmosphere.

Advantageously, I provide for a heating of the expansion nozzle **6** by the exhaust gases from the engine, which gases are thus cooled.

For this purpose, according to the embodiment illustrated by the drawings, I feed the exhaust gases through a conduit **7** to a jacket **8** surrounding nozzle **6** as far as the rear edge thereof along which the cooled burnt gases escape through another nozzle the walls of which are arranged in such manner as to produce a suction sufficient for compensating for the pressure drops occurring in the exhaust circuit above described.

Fins **9** carried by the wall forming a partition between jacket **8** and the nozzle, either on the inner face of said wall or on the outer face thereof, or again on both of said faces, facilitate the exchange of heat between the burnt gases and the air that is discharged to the outside.

Such an arrangement seems to be particularly efficacious for recuperating the energy of the exhaust gases because it permits of transferring the heat of the exhaust gases to a fluid under a pressure sufficient so that its rise of temperature is capable of substantially increasing the rate of flow after expansion.

Finally, in order to supercharge engine **3**, I may proceed as follows:

a.—either by sending a portion of the airstream compressed by the system of airscrews **4** to said engine for the feed thereof;

b.—or by subjecting a portion of this air stream to further compression in a compressor **10**, including for instance a rotor analogous to the system of airscrews above mentioned.

In the latter case, this second compressor is advantageously fixed to the end of the rearwardly extending shaft, after system **4**.

A conduit **11** serves to feed the compressed air to the engine.

Concerning the inlet orifices for the air sucked in by the system of airscrews **4**, they are advantageously distributed over the whole span of the wing, and they are constituted by at least one

slot made, for instance, according to one of the arrangements illustrated in a diagrammatic manner by Figs. 3 to 7.

In the arrangement of Figs. 3 and 4, the air that is sucked in enters, at the upper part of the interval existing between wing 2 and the corresponding aileron, in the direction shown by arrow *f*, that is to say frontwardly and downwardly.

In the arrangement of Fig. 5, the air enters through two slots located one at the upper part and the other at the lower part of the same intervals, along directions shown by arrows f^1 and f^2.

In the arrangement of Fig. 6, the air in question penetrates through a slot provided along the trailing edge of the wing.

Finally, in the arrangement of Fig. 7, the air penetrates through a slot located at the rear part of the wing upper side, in a frontward and downward direction (arrow f^1).

In all cases, guiding surfaces 12 will be provided for a correct flow of the air streams into the channel 13 which connects the inlet slot with the inlet of tunnel 5, and this channel must form a gradual curve, being advantageously housed in the wing portion joining the trailing edge with the fuselage.

Advantageously, the propelling system which has been described is combined with another propelling system including external airscrews of the usual type, located either ahead of, or behind, the wing.

For instance, as shown by the drawing, I provide two propellers or external airscrews 14^0 and 14^{00} on either side of the fuselage, respectively.

These propellers may be driven as follows:

a. Either directly by engines of the conventional streamlined type carried by the wing;

b. Or, as shown by the drawings, by engines 15^0, 15^{00}, housed in fuselage 1, with the interposition of a transmission 16.

In this last mentioned embodiment, I advantageously provide a transverse transmission shaft 17, common to both of the propellers, a free-wheel device being interposed between each engine and this transverse shaft, in order to avoid driving an engine which has undergone break-down.

Of course, these two last mentioned engines 15^0 and 15^{00} may be connected:

a. On the one hand to the conduit 11 for feeding air under pressure to engine 3; and

b. On the other hand to the exhaust conduit 7 of said engine 3.

But advantageously, I provide a compressor 18 driven by transmission 16 and connected to conduit 11 ahead of a stop valve 19 itself located ahead of the conduit 20 which connects conduit 11 with the engine 3. Another stop valve 21 may be provided in conduit 11 behind conduit 20.

It is thus possible, at small height and moderate speeds, to utilize compressor 4, 10 driven by engine 3 which actuates the propelling means the efficiency of which at moderate speeds is not so good.

On the contrary, at high speeds, compressor 18 will be used preferably because in this case it becomes difficult to use the whole power of the engines on the external propellers.

Always for the same reasons, i. e. in order to obtain the best possible total efficiency, it will be advantageous to mount airscrews 4 and 14^0, 14^{00} in such manner that they can be disconnected from their driving means. The same is true of compressors 10 and 18. Furthermore, the various airscrews should be of the variable pitch type.

Whatever be the particular embodiment that is chosen, the operation and advantages thereof result sufficiently clearly from the preceding explanations for making it unnecessary to enter into further description.

PAUL AIMÉ RICHARD.

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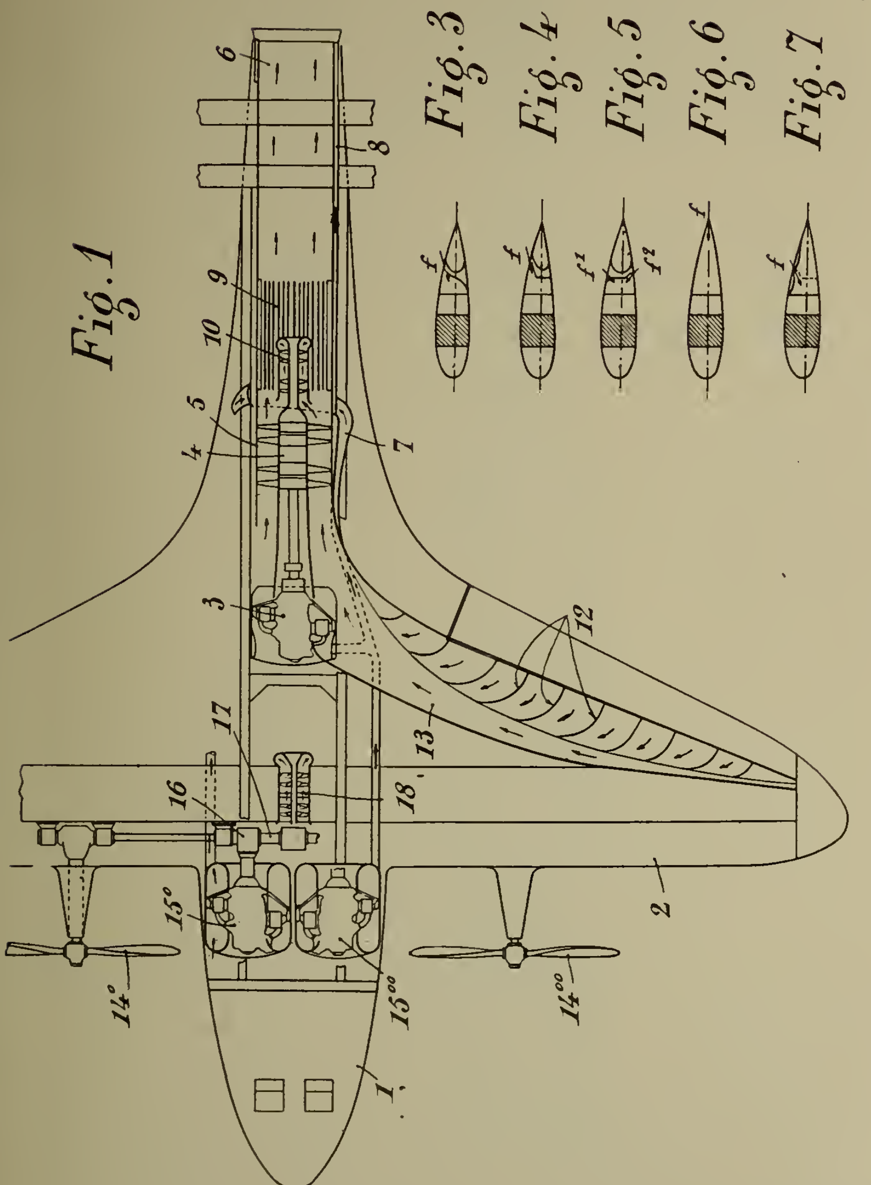

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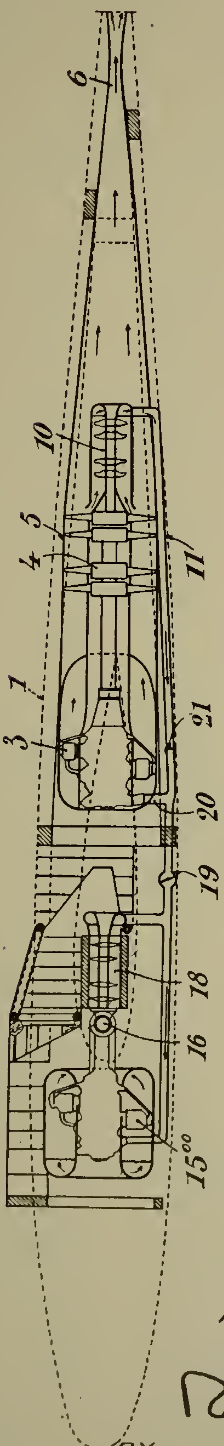
Fig. 2



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ALIEN PROPERTY CUSTODIAN

HYDRAULIC DAMPING AND STABILISING DEVICE

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Application filed June 5, 1941

In the French Patent 855,043 filed January 17, 1939 by Paul Henry Mistral is described a suspension gear for motor vehicles, in which between the suspended and non suspended part of the vehicle are arranged two pairs of hydraulic devices located respectively at the front and rear of the vehicle and hydraulically connected to one another, in each pair, by crossed pipings in a manner that the motion of the movable part of one device sets up a movement of the same amount and in the same direction of the movable part of the other device.

This system acts as a stabilising and damping device for the suspension and comprises:

(*a*) A device compensating the expansions and contractions of the liquid, and

(*b*) An adjustable valve for the damping, which sets up a parallel adjustment of the suspension and damping.

During tests effected after connection of maximum recording pressure gauges on the various pipings, the following facts have been observed:

1. The pressures involved in the stabilising action are considerably lower than those occurring during damping,

2. The damping pressures are much lower at high speed than at low speed, viz. of the order of 350 kg/sq cm at 80 km/hr against 600 kg/sq cm at 40 km/hr, and

3. The stabilisation of small oscillations is highly straining for the vehicle frame such as it is realised at present on the majority of cars.

From these facts it may be deduced that there is a certain interest in not stabilising small oscillations, but only damping them out, the limit between these two operations may be adjusted differently for the fore and aft of the vehicle, i. e. with respect to the position of the mass centre on the longitudinal axis of said vehicle.

The object of the present invention is a damping and stabilising device adapted to fulfill the above conditions and, for the purpose of illustration, an embodiment of the apparatus according to the invention will be described below, by way of example, with reference to the joined drawings, in which:

Figure 1 shows in the rest position the damping and stabilising device according to the invention, in longitudinal vertical section along the axis,

Figures 2 and 3 are vertical transverse sections respectively along the lines A—A and B—B of Figure 1, and

Figure 4 shows diagrammatically and at a smaller scale the front of a motor vehicle fitted with two hydraulic devices of the same construction as that shown in Figures 1 to 3.

As shown in Figure 4, the damping and stabilising device according to the invention, adapted to be fitted either to the front wheels, as shown, or to the back wheels of a motor vehicle, comprises two similar hydraulic devices A and A_1, connected to one another as explained below, by two transverse pipes B, B_1, while suitable connecting rods connect the movable part of the devices to the non suspended part of the vehicle.

In Figures 1 to 3 it is seen clearly that each hydraulic device comprises a body 1 comprising in its central part a chamber 2 constituting an oil reserve tank and closed hermetically at its upper part by a lid 3 with a stuffing 4.

This hollow body further comprises two circular bores of the same or different diameters, divided each by chamber 2 into two portions constituting two cylinders arranged in the extended direction of one another and referred to respectively as 5, 5*a* for the upper, and 6, 6*a* for the lower.

Inside the cylinders 5, 5*a*, closed, at their ends, by plugs 7 and 7*a*, is mounted slidably in both directions a piston 8 which may be provided in addition, as shown, with stuffing devices such as leather cups 9, 9*a*.

In the example shown, the piston 8 is connected, over a block 10, to a lever arm 11 keyed to an axis 12 rotatable in the bearings 13 of the hollow body 1 and carrying an outer lever 14 connected by a connecting rod 15 or any other suitable part, to the axle 16, as shown in Figure 4.

The movements of piston 8 are thus controlled by the oscillations impressed to the axle 16 during the travel of the vehicle, the piston moving at the same time as the axle or the part replacing the latter in the case of independent wheels.

In the lower cylinders 6, 6*a* is movable a second piston 17, 17*a*, eventually provided with packings such as leather cups 18, 18*a*, and comprising stops 19, 19*a*. These two cylinders 6, 6*a* are closed respectively by plugs 20, 20*a*, the first of which carries a stop stud 21 in a non sound producing substance, and the second a stop 22 provided with another stop stud 21*a* in the same substance as the first.

The piston 17, 17*a* is brought into contact with the stud 21, as shown in Figure 1, by a spring 23, the tension of which is such that it may only overcome the sliding resistance of said piston in the cylinders 6, 6*a* during the idle periods of piston 8, i. e. when the vehicle is stopped or when it is not subjected to oscillations during its travel.

At rest, with the piston 17, 17a in each of the two apparatus A, A_1 located at the front and rear of the vehicle in contact with the stud 21 by the stop 19, as shown in figure 1, the interval between the stop 19a and stud 21a forms a space adjusting, as explained below, the range of damping without stabilisation, and to which a suitable length is to be given for the front and aft of the vehicle.

The hollow body 1 comprises, at its upper part, two boxes 24 and 24a in which are located respectively two valves 25 and 25a which, during the idle periods of piston 8 and during the stops of the vehicle, are normally maintained by their weight in the open position as shown in figure 1, and set up communication between the oil reserve tank 2 and the cylinders 5, 5a over channels 26, 26a and the valve seats 25, 25a.

Cylinder 5 further communicates, as seen in figure 3, with cylinder 6 by means of two channels 27, 28 leading, the first, into the upper part, and the second into the lower part of a box 29 inside which is arranged a needle valve 30 adapted in a manner to be moved vertically and to penetrate more or less into the central conical aperture 31 of a washer 32 in order to adjust the cross-section of the annular passage formed between said aperture 31 and the point of the needle valve, and setting into communication with one another the two channels 27, 28 and, consequently, both cylinders 5 and 6.

The two cylinders 5a and 6a are constantly in communication with one another by means of a channel 33 drilled into the wall common to both cylinders, as seen in figure 1.

The two lower cylinders 6, 6a of each of the two apparatus A, A_1 in figure 4 are provided with two nipples 34, 34a arranged respectively to one another as shown in figure 4, and to which are connected two pipes B, B_1 connecting both apparatus A, A_1 of the front or aft of the vehicle in such a manner that the nipple 34 of the left apparatus A be connected to nipple 34a of the right apparatus A_1, while nipple 34 of the right apparatus A_1 is connected to nipple 34a of the left apparatus A.

Due to this arrangement, the central oil reserve tank 2 of each device A, A_1 communicates with the bores or cylinders 5, 5a which communicate with the bores or cylinders 6, 6a, so that all these cylinders and both crossed pipes B, B_1 connecting the two devices A, A_1, as described above, are filled with oil.

Each of the valves 25, 25a is meant to compensate the expansions and contractions of the liquid under the effect of variations of the outer temperature or of the temperature of the liquid, and is only applied against its seat when an overpressure is set up in the circuit of said liquid by the displacements impressed on piston 8 by the oscillations transmitted to the vehicle by road bumps.

The needle 30 interposed between the bores or cylinders 5 and 6 of each device A, A_1, controlling the communication between them, is inserted, as explained above, in the central conical aperture 31 of a washer 32 which, under normal conditions, is maintained applied against an inner flange of box 29 by a light spring 35 inserted between said washer 32 and a collar 33 integral with the needle.

The stem 37 of needle 30 carries, fixed to the latter below the collar 33, a ring 38, the lower base of which forms a helical ramp 39 maintained in contact by a spring 35 with another helical ramp 40 formed at the upper end of a vertical hollow shaft 41 rotating inside the body of box 29 and in the central bore of which the stem 37 of the needle is mounted vertically slidable and maintained against any angular displacement by the ring 38 in a vertical groove 42 of which is freely engaged a screw 43 fixed in the box 29.

For giving the needle 30 the required vertical displacements and thus varying the cross section of the annular passage formed between said needle and the central aperture 31 of the washer 32, as explained, the shaft 41 carrying the helical ramp 40 is connected, by means of a crank 44 keyed to said shaft, to a suitable control device allowing the driver of the vehicle to give from a distance to said shaft 41 angular displacements of the required direction and amplitude for obtaining, by means of the helical ramps 40 and 39 a lift or a downward motion of the needle 30 and for permitting, as will be explained, a damping of the small oscillations, and combined damping and stabilisation of oscillations of larger amplitude.

The operation of the apparatus described above is as follows:

When, owing to road bumps, piston 8, figure 1, is moved in cylinder 5 towards the left of this figure, the liquid, carried along in this movement, first closes the valve 25 and is then discharged through the channel 27 into box 29 of valve 31, and through channel 28 into cylinder 6. Since piston 17 is subjected only to the light resistance of spring 23, it will be pushed towards the right, thereby discharging into cylinder 6a, under the push of piston 17a integral with 17, an amount of liquid equal to that entered into cylinder 6. This liquid will enter, through channel 33, into cylinder 6a and thus fill the space cleared in cylinder 5a by the motion of piston 8 towards the left.

If the move of piston 8 is only small, it may happen that piston 17, 17a be moved to the right only by an amount equal at most to the distance separating the stop 19a from the stud 21a; in this case, the device will operate only on one side of the vehicle.

Upon return of piston 8 towards the right, i. e. after the road bump has been passed, the liquid is delivered by said piston of cylinder 5a into cylinder 6a, piston 17a moves, in turn, towards the left and piston 17 integral with 17a discharges an equal amount of liquid into cylinder 5 over valve 30 which produces the damping effect for which it has been adjusted.

If, on the contrary, piston 8 is moved by a large amount towards the left, it will discharge, first into cylinder 6, an amount of liquid equal to the maximum permitted by the space separating the stop 19a from stud 21a; piston 17, 17a is thus moved to the right of figure 1 and stopped, at the end of its stroke, by the abutment of stop 19a against stud 21a, so that the excess of liquid discharged by piston 8 in succession into cylinder 5 and cylinder 6 will escape from the latter through nipple 34, figures 1, 3 and 4, and be discharged from said cylinder 6 of one of the apparatus, A for instance, figure 4, into the corresponding cylinder 6a of apparatus A_1, through the pipe B and nipple 34a as seen in figure 4.

With the piston 17 of this second apparatus A_1 locked by its stop 19 which is in contact with stud 21, the liquid then passes through channel 33 into cylinder 5a of said apparatus A_1, thereby repelling piston 8, which, by its other face, discharges

liquid from cylinder **5** into cylinders **6**a and **5**a of the first apparatus A through the nipple **34**, pipe B_1 and nipple **34**a of said apparatus A.

It will be seen that these various movements set up: the first action of closing one or other of the compensating valves **25**, **25**a, the second action of damping out alone the small oscillations, and lastly the third action of combined stabilising and damping of the larger oscillations.

The described arrangements are, of course, indicated only by way of example, the shapes, substances and dimensions of the elements constituting the damping and stabilising apparatus, and the constructional details may be modified without at all departing from the present invention.

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PUBLISHED
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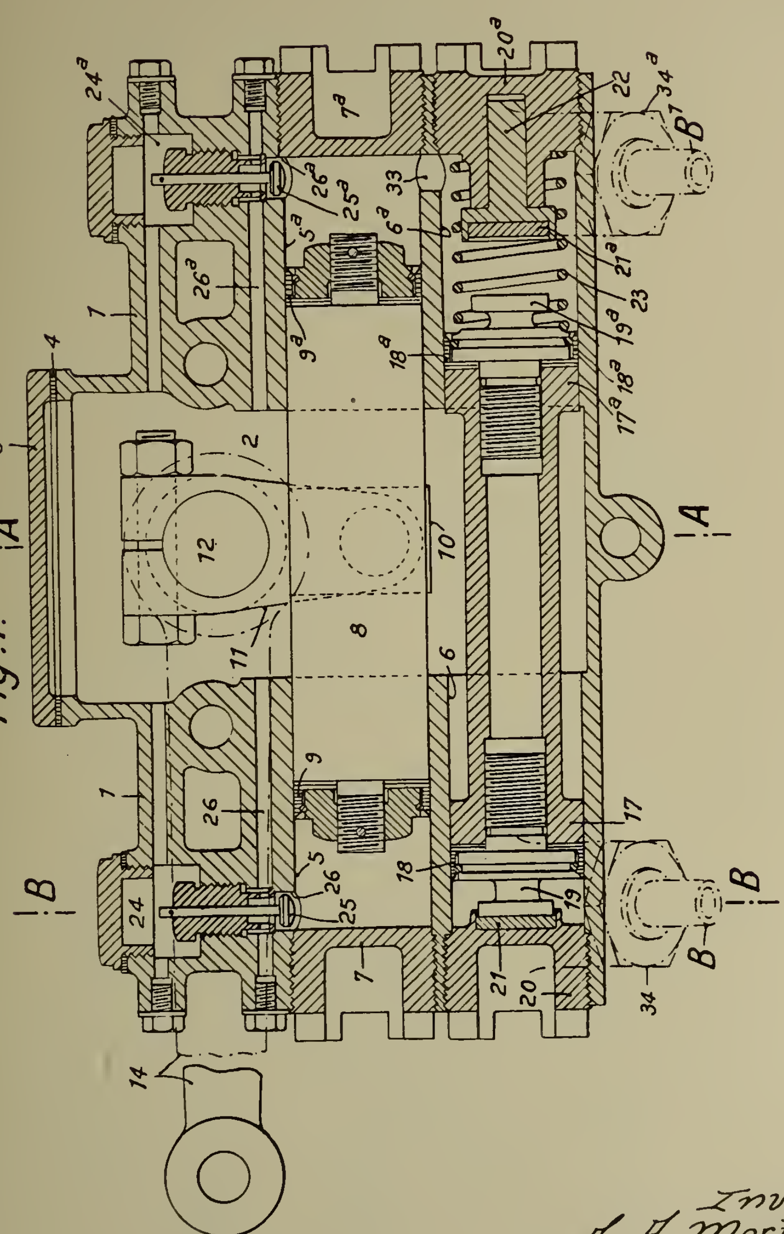

Fig. 1.

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Fig. 4.

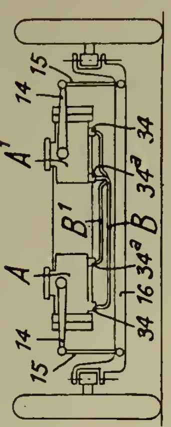


Fig. 3.

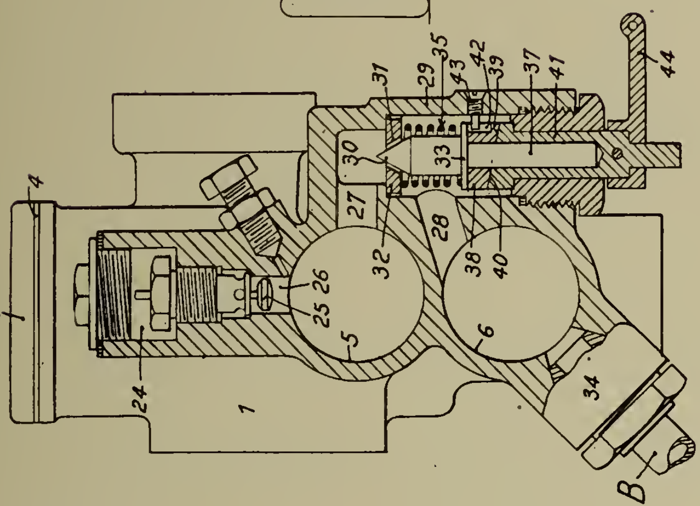
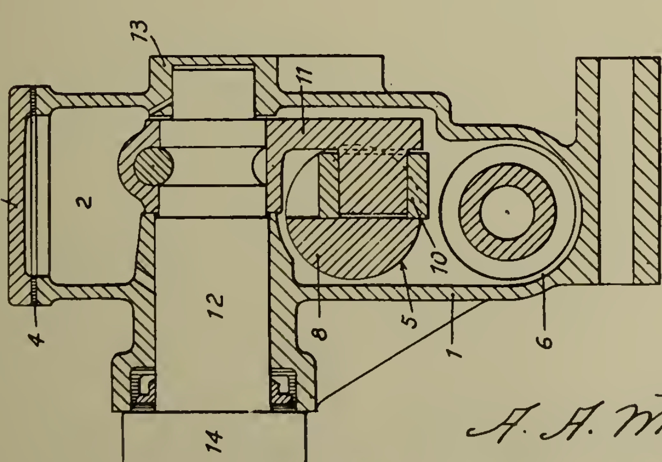


Fig. 2.



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ALIEN PROPERTY CUSTODIAN

ORIENTATION SYSTEMS

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Application filed June 11, 1941

My invention relates to improvements in systems for orienting or pointing an apparatus on a determinate direction or objective, and more particularly in such systems in which the apparatus to be pointed is located upon a moving body, such as a ship, which is continually oscillating by rolling and pitching.

An important object of my invention is to provide a novel method for automatically pointing an apparatus in the direction of a distant source of radiant energy. This source can radiate waves of different nature, for instance visible or invisible luminous waves and electro-magnetic waves of short wave length, but preferably in embodiments of the invention, a source of invisible luminous rays is used, for instance a source of infra red rays.

Another particular object of the invention is to provide a system for automatically and reciprocally maintaining two orientable apparatus pointed each on other, which are located upon distant moving bodies subjected to continual movements, such as ships, and thus to realize a safe and permanent telecommunication between two ships, in spite of continual oscillations and respective and relative displacements of said ships.

The invention provides also improved means for searching a correspondent by sweeping of the horizon in order to establish this telecommunication, which will be afterwards automatically secured by the novel method above mentioned, at the mercy of the correspondents.

A further object of the invention is the use of this telecommunication for the transmission of intelligence.

Still another object of the invention is to indicate automatically on board of a ship the direction of another ship, and also the approximate distance of the same.

Other objects and advantageous features will become apparent from the description hereafter and appended claims.

The method according to the invention comprises the steps of directionally receiving and focusing in the apparatus to be pointed a beam of the radiation emitted by the distant source of radiant energy, producing an electric effect by said focused beam in dependance of the angular relation between the directional axis of the apparatus to be oriented and the direction of the radiating source and controlling the movement of the orientable apparatus by said electric effect.

In accordance with a preferred embodiment of the invention, a source of invisible luminous rays is used, particularly a source of infra red rays, the directional receiving of these rays and the focusing of the same being performed by a optical system included in the apparatus to be oriented. This system leads and concentrates the infra red rays on a detecting photo-electric device in dependence of the angular relation between the optical axis of said optical system and the direction of incident infra red rays, and the output of the detecting device controls the displacement of the apparatus to be oriented; by this system the detecting device is not influenced when the optical axis of the optical system coincides with the direction of the incident infra red rays, while on the contrary, when said optical axis stands at an angle to the direction of the incident infra red rays, the photo-electric detecting device is influenced and causes the control of the movement of the orientable apparatus for bringing back said optical axis in coincidence with the direction of incident infra red rays, and consequently the orientable apparatus in desired direction.

By associating a source of infra red rays with the directional optical system in the vicinity of this, inside the orientable apparatus, it is obtained a system capable of emitting in his turn a beam of infra red rays which follows truly the displacements of the orientable apparatus and can thus works out a distant control of an orientable apparatus according to the above mentioned method.

In this association, the effect produced at a distance by the beam of infra red rays is considerably increased because the directional property of said beam and optical receiving system, which permits either an important increase of the range for a given power of the beam, or a decrease of this power for a predetermined range.

By coupling two systems such as the latter, the beam of one system being used for automatically controlling the orientation of the other system and reciprocally, it becomes possible to reach the object above mentioned, namely, to maintain pointed each on other, regularly and permanently two orientable apparatus lying upon distant moving bodies. This mutual control at a distance also permits safe and uninterrupted optical telecommunication between both moving bodies, such as ships, as above mentioned.

Further on account of the fact that each of the beams is constantly pointed on each of the optical receivers a third party has no possibility to disclose the position of said orientable apparatus.

In this telecommunication system, it is important to prevent disphony, that is the influence of the very powerful beam on the adjacent optical receiver. This end is reached by a feature of the invention according to which the respective luminous beams, projected by the orientable apparatus, are breaked at different frequencies, particularly by means of rotative obturating discs drived by electric motor, which permits the association of electric filters with each of the optical receivers.

The invention also provides means allowing to stabilize these breaking frequencies at fixed and predetermined values by producing electric currents respectively dependent of said frequencies and intended to act on the speed of the respective driving motors, which may be also provided with speed stabilizing means through electric filtering.

For obtaining with certainty a fast connection between correspondents the invention forsees that during the listening all receivers are adjusted and sensitized a predetermined breaking frequency f, while the luminous beams have a different breaking frequency f^1. For calling, the set, wanting to emit, reverses these two frequencies, whereby it can enter in touch with a correspondent and afterwards the bilateral communication can be maintained.

For searching a correspondent in order to establish the telecommunication, it is provided improved means for sweeping the horizon. According to a preferred embodiment of the invention, a gyroscope having a vertical axis is used, which maintains each luminous beam in horizontal plane and permits to sweep the horizon by means of said beam. Preferably this sweeping takes place at a great speed and means are foreseen to decrease considerably this speed when the correspondent has been touched up.

According to an improved modification, the gyroscope is mounted in the orientable apparatus and has one of its suspension axis parallel to one of oscillation axis of the orientable apparatus, so that the gyroscope has only to disclose and to compensate weak angular displacements. Such angular displacements are translated advantageously by high frequency electric currents with the help of means having no sliding contact.

According to a preferred embodiment of the invention the movement of the orientable apparatus is secured by a electric motor in continuous rotation associated with electromagnetic clutches, which are preferably formed by a differential system. Each clutch secured the connection of two coaxial shafts, which are thus rapidly interchangeable. The displacement towards the top and the bottom, also towards the right and the left, with a great and slow speed is obtained by identical clutches actuating a suitable mechanism.

The optical projector and receiver of each orientable apparatus comprise preferably lenses adapted to form simultaneously water-tight joints. Besides, the evacuation of the heat produced within projector is secured by a cap made in a metal having a high heat conducticity, such as aluminium, which cap is provided with internal ribs picking-up calories delivered by the projector lamp and evacuating these on external ribs.

Another feature of the invention resides in the use of means which permit to limit the output level of amplifiers associated with photo-electric cells, and to make said amplifiers act differentially on the orientation mechanism of the orientable apparatus.

For a clear understanding of the manner the objects of the invention are achieved, reference may be had to the accompanying drawings illustrating a preferred embodiment of the invention, it being understood, however, that the specific illustration is for the purpose of disclosure only and places no limitation upon the invention.

In the drawings

Fig. 1 represents in schematic form an automatic orientation system embodying the method according to the invention.

Fig. 2 shows in schematic form a similar system with relaying.

Fig. 3 represents in schematic form the method according to the invention as applied to the mutual and reciprocal orientation of two orientable apparatus located on distant moving bodies.

Fig. 4 is a plan view of an embodiment of an orientable apparatus according to the invention.

Fig. 5 is an elevation, partly in vertical section, of Fig. 4, showing a control mechanism for the apparatus to be oriented.

Fig. 6 represents in schematic form the basis arrangement of a gyroscope with vertical axis inside the orientable apparatus for securing said apparatus to be maintained on the horizontal plane.

Fig. 7 illustrated in schematic form an electrostatic control of the orientable apparatus by the gyroscope.

Fig. 8 represents in schematic form the arrangement of clutches acting upon the mechanism of Fig. 4.

Fig. 9 illustrates in schematic form the circuit arrangement for the control of the orientable apparatus.

Fig. 10 shows a differential circuit arrangement for the control of the clutches.

Fig. 11 illustrates, in vertical section an embodiment of an orientable apparatus with a single photoelectric cell.

Fig. 12 represents the obturating disc associated with an distributor included in the embodiment of Fig. 11.

Fig. 13 is a basis view of a three perpendicular axis suspension enabling the orientable apparatus to be suspended in indifferent equilibrium.

Fig. 14 represents the arrangement of four photoelectric cells for the embodiment of Fig. 13.

Referring to Fig. 1, the embodiment for carrying in effect the method according to the invention comprises the arrangement on a moving body, especially a ship **1**, of an orientable platform **2** to be maintained continually and automatically in the direction of a remote source radiating infra red rays **3**. The orientable platform **2** is provided with an directional optical device including a lens **4** and a set of mirrors **5** standing at an angle each other; the lens **4** directs the incident infra red rays on the set of mirrors, which concentrates said rays on a set of photoelectric cells **6**. This set of photo-electric cells acts upon a mechanism **7**, illustrated here in schematic form, but which be described later, the function of which is to move the orientable platform. The system is so arranged that, when the ship has no movement, the optical axis of the lens **4** is pointed on the source **3**, and the infra red rays, which are concentrated by the mirrors **5**, do not impinge on the photo-electric cells **6**. On contrary, when the ship has continual oscillating movements or when the location of the source **3** changes, the optical axis of

the lens 4 stands at an angle to the direction of the source 3, and the result is that the infra red rays impinge on either photo-electric cell 6. The excited cell causes then through his onput circuit the control of the mechanism 7 and the latter brings back the orientable platform in the direction of the source 3.

The system above described may be improved by the adjunction to the orientable frame-work of a radiation source, such as a source of infra red rays, which may be used for automatically orienting another distant orientable apparatus, similar to the apparatus illustrated in Fig. 1. This improvement is illustrated in schematic form in Fig. 2. In the orientable platform or frame-work 2, besides the apparatus previously described, a search light or projector is arranged, particularly a projector of infra red rays, this axis of which is parallel to the axis of the optical system 4—5 and including a luminous source 8 of great intensity and surface which is located in vicinity of a concave mirror 9. This mirror reflects luminous rays from a source of light 8 under a wide angle, so that a good luminous efficiency is obtained. At 10, upon a rotative disc 11 breaking the luminous beam, is formed a magnified image of the source 8, which is projected to infinity by means of a lens 12. On account of the great surface of the image at 10 and the small focal length of the lens 12 it is possible to obtain a very high degree of illumination for a great surface, and consequently to realize a beam with a large cone of light, which may be easily picked-up. An electric motor 13 drives the disc 11 at a constant speed, so that the breaking frequency of the luminous beam is exactly determined, whereby the system is not influenced by the daylight or other parasitic light and the amplification at the reception is facilitated. In the described system, it is advantageous to utilize invisible radiations, particularly infra red rays, by use for instance of suitable filters.

In the improved system thus establish, the light projectors 8, 9, 12, in fixed relation with the orientable platform or frame-work 2, is subjected to the same displacements as said frame-work, which displacements result from angular digressions between the direction of the source 3 and the optical axis of the receiving device 4—5—6, so that the luminous beam supplied by the projector 8, 9, 12 can relay at a distance these angular deflections for controlling an apparatus, located for example at 15, similar to the apparatus illustrated in Fig. 1.

By pairing two systems similar to this illustrated in Fig. 2, located upon distant moving bodies, such as ships, it becomes possible to ensure a mutual and reciprocal control of two orientable frame-works, and consequently a safe and uninterrupted telecommunication between two ships. The Fig. 3 illustrates in schematic form such a pairing system of two orientable frame-works located upon two distant ships 1 and 1^a, which are subjected to the action of the surge and can move about. In this figure, the same reference numbers are used to designate the same pieces as above. The first ship 1 supports an orientable frame-work 2 fitted up in the above described manner, that is comprising a light projector including a concave mirror and a lens 12, which supplies from a source of light 8 a luminous parallel beam 14, breaked by a rotative disc 11. This beam impinges on the optical receiving device included within the orientable frame-work 22, which is mounted on board of the ship 1^a; thence the beam is directed by a lens 4^a on a set of mirrors 5^a standing at an angle to each other and from these condensed on photo-electric cells 6^a. This arrangement, as above stated, ensures the automatic pointing of the orientable frame-work 2^a on the projector 8—9—12 of the orientable frame-work 2 mounted on board of the ship 1, by means of a mechanism 7^a controlled by the photo-electric cells 6^a. In the pointable frame-work 2^a is arranged a projector including a concave mirror 9^a and a lens 12^a, which supplies from a luminous source 8^a a parallel beam 14^a breaked by the rotative disc 11^a. The optical axis of this projecting device having a fixed position in relation to the optical axis of the receiving device 4^a—5^a, which is maintained in a pointed position on the projector 9—12 of the orientable frame-work 2, it results therefrom that the beam 14^a is parallel to the beam 14 and just pointed on the frame-work 2 of the ship 1. There it impinges on the optical receiving device included within the frame-work 2, which is similar to this of the frame-work 2^a, namely including a lens 4 associated with a concave mirror set 5 for directing and condensing the luminous beam on a set of photo-electric cells 6. This arrangement ensures the automatic pointing of the orientable frame-work 2 on the projector 9^a—12^a by means of the mechanism 7 controlled by the photo-electric cells 6. Thus each luminous source 8, 8^a maintains pointed on it the orientable frame-work located on the other ships so that the orientable frame-works 2 and 2^a of both ships remain continually pointed each on other, whatever may be the movements caused by the surge and the relative displacements of both ships.

Owing to these continually pointed each on other frame-works, the above described system permits to establish a bilateral, regular and uninterrupted telecommunication between the two ships. This telecommunication may be either optical, as described in the instance, or performed by way of electromagnetic waves by utilizing a directional wireless beam at each emitting device.

For preventing the local optical reaction, that is the straight action of the projector on the adjacent photoelectric device, it is advantageous to use different breaking frequencies for the luminous beams 14 and 14^a. For instance the beam 14 may be breaked at a frequency of 1000 cycles per second, and the beam 14^a at a frequency of 1500 cycles per second; correspondingly the photo-electric cells included in the receiving devices are sensitized respectively the one 6^a at said frequency of 1000 and the other 6 at the frequency of 1500. Advantageously each photo-electric cell is associated with an electric filter which makes the amplifier of one pointable frame-work unable to be influenced by the adjacent projector located in the same frame-work, while making said amplifier excessively sensitive to the breaking frequency of the frame-work located on the other ship. Also the breaking of the beam may be used simultaneously in combination with a separate photo-electric cell for supplying an electric current which, after amplification, is intended to stabilize the speed of the electric motor respectively 13, 13^a at a constant value. This stabilisation may be obtained by means of an electric discharge tube, to the control electrode of which is applied the said electric current, while the anode current of said tube influences the excitation circuit of the motor 13, 13^a driving the breaking disc 11.

According to a preferred embodiment of the

mechanism 7 or 7a controlled by the set of photo-electric cells 6 for moving the orientable frame work, said mechanism is mounted on a dual cardan suspension and a vertical axis gyroscope included within the orientable frame-work and having a gravity step-back device, ensures the horizontal stability of said frame-work; consequently the set of photo-electric cells 6 causes only the control the frame-work displacements in the horizontal plane. This embodiment is illustrated in Figs. 4–5.

Each orientable frame-work 1 or 1a is mounted upon a pedestal base 15 and rotation and oscillation of this frame-work are obtained by a mechanism 16 arranged in the lower part of the pedestal base 15. The movement of the frame-work in the vertical plane is controlled by a stabilizing gyroscope 17, the arrangement of which will be described later, and in the horizontal plane by two photo-electric cells 6r and 6l. For the purpose the frame-work is supported by a spindle 18 and a right angle bevel gearing 19, 20 causes the optical axis of the frame-work 1 to be deviated either towards the top or the bottom. The pinion 20 is connected with a vertical axis 21 which is controlled by a toothed wheel 22 driven by a worm 23. The support 24 for the axis 18 is connected with a toothed wheel 25 driven by another worm 26, which secures the rotation of the framework round the vertical axis.

For supplying the amplifiers associated with the photo-electric cells and the projector included within the frame-work 1, electric connections must be used. According to the invention, the vertical shaft 21 is tubular and thus permits all conductors to be passed towards the apparatuses of the frame-work 1. This tubular shaft is water-tight so that the gear case enclosing the wheels and worms 22, 23, 25, 26 may be filled with oil.

The driving of the wheels 22 and 25 is controlled by electromagnetic clutches enclosed within a case 27; these clutches have a great time constant and a progressive effect. The whole is driven by an electric motor 28 in continuous rotation.

The motor 28 and the clutches 27 are enclosed within a case not illustrated, and a suitable water-tight and flexible joint is inserted between the pedestal base 15 and the frame-work 1, so that the whole is not infuried by spray.

The stabilisation of the orientable frame-work 1 in the horizontal plane is realized by means of the small size gyroscope 17 in the manner described thereafter, referring to Fig. 6, which illustrates in schematic form the basis arrangement and operating way of the gyroscope within the framework 1. This gyroscope comprises a revolution body 29 journalling at 31, 31 within a ring 32 rotatable, in his turn, at 33, 33 within another ring 34. This latter rotates at 35 within a pedestal base 36 fastened to the frame-work 1. The spindle 30 is brought back in vertical direction by a heavy mass 37 and the ring 34 remains permanently in the horizontal position. The position of the pedestal base 36 within the frame-work 1 is so arranged that the suspension horizontal axis A B of the frame-work 1 is parallel to the suspension horizontal axis C D of the gyroscope. Thus the optical axis of the frame-work 1 is parallel to the axis O P of the gyroscope, that is perpendicular to the common direction of the respective cardan suspension axis of the frame-work 1 and gyroscope. Owing to this arrangement, it is no longer need to stabilize the frame-work 1 in two directions but only in one direction for ensuring the horizontality of the luminous beam. When under effect of the ship oscillations, the frame-work 1 and consequently the pedestal base 36 of the gyroscope, begin to list over the horizontally maintained ring 34, the list is translated immediately by above described means for controlling the clutches enclosed in 27, and the orientable frame-work is operated for bringing back the optical axis in the horizontal plane. In these conditions the gyroscope has only to disclose weak angular deflections of the frame-work 1 in relation to the stabilizing horizontal position of the optical axis, that is angular deviation of one to two degrees about, while the oscillation amplitude of the ship can reach thirty degrees.

According to a preferred realization the angular position of the small size gyroscope in relation to the frame-work 1 is disclosed by means of high frequency currents, whereby it is prevented any sliding friction which would have a tendency to occur, for instance under action, of a brush rubbing on a contact piece. The amplitude is disclosed proportionally so that in the desired clutch a current is obtained which varies independence of angular deviation between the true and momentary position of the frame-work.

This high frequency current control is illustrated in schematic form in Fig. 7. The ring 34 of the gyroscope 17 is connected in any suitable manner with an electrode 37 facing two electrodes 38 and 39 fastened to the frame-work 1. The variable capacity between 37 and 38 forms a part of an oscillating circuit not illustrated; the variable capacity between 37 and 39 form a part of another oscillating circuit not illustrated. The resonant frequencies of these circuits, consequently the intensities of respective currents flowing through said circuits, are varied necessarily in accordance with the relative position of the electrodes 37, 38, 39 and consequently in accordance with the relative direction of the optical axis of the frame-work 1 and the suspension horizontal axis of the gyroscope. After amplification these currents act upon the corresponding clutches 27 which control the rotation of the worm 23 in the desired direction. This system, which can offer any desired sensitiveness and working rapidity, compensates automatically the oscillations owing to rolling and pitching and also the acceleration which may be exerted on the ship.

In the telecommunication system above described, the initial finding of a correspondent is difficult since the optical axis of both frame-works, which are moving in space and independent, must be brought in coincidence. For making easier this initial finding, it is foreseen that, during the period of watching, the orientable frame-work is moved continuously in the horizontal plane until it receives a luminous impulse from his correspondent. At this instant the orientable frame-work is brought automatically under control of the received luminous beam, by means of the method above described. The initial calling of the correspondent is obtained by momentarily stopping the horizontal sweeping during a time and by lighting the projector in the most likely direction of the correspondent. If this latter is responding, an automatic mechanism releases the control which en-

sures the pointing of both frame-work on each other. In order that the correspondent finding may be rather fast, rather fast alternative movement is imparted to the orientable frame-work until such time as the beam of the correspondent has been received. At this instant the frame-work is subjected on contrary to slow displacements which permit the control. In other words, one changes from the horizontal sweeping taking place at great speed during the watching period to adjustments at slow speed during the control period.

This improvement is accomplished by a particular arrangement of the clutches enclosed in 27, which is illustrated in schematic form in Fig. 8. The motor 28 drives a shaft 40 which may be coupled with another shaft 42 by intervention of the clutch 41 in order to point the orientable framework upwards by means of the transmission gear 22—23. When the clutch 43 is operated, the shaft 42 rotates in the opposite direction, owing to the gearing 44, and point the frame-work downwards.

A clutch 45 causes a shaft 46 to rotate slowly, while another clutch imparts to said shaft 46 a fast rotation by intervention of a gearing 48. Finally clutches 49 and 50 cause the tubular shaft 24 of the mechanism 16 (Fig. 5) to rotate at right hand and left hand by means of a gearing 51, and consequently the orientable frame-work 1 follows these displacements by intervention of the transmission gear 25—26. This pointing at right hand and left hand may be thus accomplished rapidly or slowly according to the intervention of clutches 47 or 45.

The clutches 41 and 43 are controlled by the gyroscope 17, through intervention of the device of Fig. 7, during the watching period; clutch 47 causes the shaft 46 to rotate rapidly, and clutches 49 and 50 control the alternative sweeping of the horizon by the optical axis of the frame-work according to the desired angle. If, in the course of this fast sweeping, either of cells 6^r, 6^1 is influenced by a suitable modulated luminous beam, the great speed clutch 47 is replaced automatically by the slow speed clutch 45; clutches 49 and 50 are controlled by photo-electric cells 6^r and 6^1 and cause the frame-work 1 to be pointed on the received beam. Simultaneously a particular relay lights the source 8 and starts the small motor 13 which modulates the light beam of the source 8.

The Fig. 9 illustrates in schematic form this arrangement. During the watching period, a relay 52 controlled by photo-electric cells 6^r and 6^1, is not excited, and its movable contacts 53, 54, 55, 56 are in the illustrated position. The motor 28 is rotating and the great speed clutch is supplied with current by contact 56, so that the frame-work 1 is rotating rapidly, at right hand for instance. After a time, the frame-work 1 causes a fork 57 to rock, which instead of making contact with fixed contact piece 58, as illustrated in the drawing, passes over contact 59; this has as a result that clutch 49 is no longer excited; while clutch 50 starts in operation, so that the orientable frame-work begins to rotate rapidly at left hand. The frame-work thus performs the horizontal sweeping above mentioned.

As soon as either of cells 6^r or 6^1 receives through the lens 4 the suitably modulated radiation from the other ship, amplifiers 60 and 61 supply by a voltage divider 62 the relay 52 which attracts its armature. This has as a result that the movable contact 55 supplies with current the clutch 45, while the circuit of the clutch 47 is open by the movable contact 56, which causes also the luminous source to light. On the other hand amplifiers 60 and 61 supply with current through movable contacts 53 and 54 the clutches 49 and 50, which maintain automatically the orientable frame-work pointed on the luminous beam of the correspondent. The relay has a time limit release, so that it is not influenced by short interruptions of its exciting current when the incident beam changes from one photo-electric cell to the other. But, if for any reason, the communication has been interrupted, the system returns automatically to the watching state.

In this system local reaction of the projector, that is direct action of the projector on the adjacent photo-electric cells, is prevented by use of different breaking frequencies for the luminous beams, as already mentioned. During the watching period photo-electric cells 6^r and 6^1 are sensitized for instance, to a breaking frequency of 1500 cycles per second, while, on contrary, said cells are particularly adapted to give no response to the frequency of 1000 cycles per second, that which the rotative disc 11 imparts to the beam of light of the source 8.

After having picked up the beam of the correspondent, which is also in watching condition, one ship for calling sends a settled signal "demand-watching"; at this instant the operator changes the breaking frequency of the projected luminous beam and also the frequency of electric filters associated with output circuits of photo-electric cells. During the demand period, the photo-electric cell device is sensitized for instance to the frequency of 1000 cycles per second, while the luminous beam is breaked at the frequency of 1500 cycles per second.

Once the telecommunication established, the frame-work having called keeps its new adjustments, namely emission at 1500 cycles per second and receiving at 1000 cycles per second, while the other frame-work keeps the adjustments corresponding to the watching period, namely emission at 1000 cycles per second and reception at 1500 cycles per second.

In these conditions no interference is feared between there and back luminous beam, because the communication between the two ships is ever started by either of correspondents, and by choosing the breakings different in frequency, the communication may be ensured without fear of interference.

The range of said telecommunication may be excessively variable, the luminous beam strength varying not only with distance, but also with opacity of air or fog, so that the intensity relation at the reception may be varied from 1 to 10^5. This is a great difficulty. On the other hand the supply voltages of the board main are frequently variable and amplifiers gain are very irregular.

These drawbacks are overcome by thereafter described means. Each amplification channel has an automatic gain control which adjusts automatically the output level at the suitable value. The gain is preferably settled upon the general output level; an electric filter permits the signal amplitude having the desired characteristic frequency to be picked up; thus the quotient of the background noise and the effective signal is measured automatically.

Moreover in order that the orientable frame-work response towards right-hand and left-hand takes place truly, the invention contem-

plates the use of a differential detector device between the amplifier output and electromagnetic clutches 27, which device is described thereafter in reference to Fig. 10. Windings 63^l and 64^r are respectively the amplifier output windings. With the winding 63^l are coupled two windings 65^l and 65^r which supply two respective circuits including to one a rectifier 66^l associated with a condenser 67^l and a resistance 68^l, the other a rectifier 66^r associated with a condenser 67^r and a resistance 68^r. Both rectifiers 66^l and 66^r are arranged in reverse connection, in such a way that the continuous voltages across resistances 68^l and 68^r have reversed polarity as indicated in Fig. 10. Likewise with the winding 64^r are coupled two windings 69^l and 69^r which supply two respective circuits including the one a rectifier 70^l associated with a condenser 71^l and a resistance 72^l, the other a rectifier 70^r associated with a condenser 71^r and a resistance 72^r. Both rectifiers 70^l and 70^r are arranged in reversed connection, so that the continuous voltages across resistances 72^l and 72^r are reversed polarity as indicated in Fig. 10. The connection 73^l supplies with current the clutch 50, of Fig. 9, which causes the orientable frame-work 1 to be moved towards the left hand, and the connection 73^r supplies with current the clutch 49 of Fig. 9, which causes the orientable frame-work to be moved towards the right hand. If an electric impulse translated by the photo-electric cell 6^l has as a result to make a voltage of value A appear across the resistance 68^l, on contrary a voltage of value —A appears across the resistance 68^r. Likewise, if an electric impulse translated by the photo-electric cell 6^r to the winding 64^r has as a result to make a voltage of value B appear across the resistance 72^r, on contrary a voltage of value —B appears across the resistance 72^l. The connection 73^l thus applies to the clutch 50 a differential voltage of value A—B, and the connection 73^r applies to the clutch 49 a differential voltage of value B—A. For instance, if A=10 and B=1, figures which correspond approximately to the case in which the frame-works to be oriented each on other are remote, and that clutches 49 and 50 be settled in order to work at 2, the clutch 50 only works, when the photo-electric cell 6^r is excited by the luminous beam from the remote projector, and that as with as without use of the differential detector device. But if both orientable frame-works are near, that is A=10,000 and B=1,000, each of photo-electric cells 6^l and 6^r would supply without the differential device a sufficient current for simultaneously exciting the clutches 49 and 50, and consequently the system would be inoperative. On contrary with use of the differential detector device the difference between A—B and B—A, which was 18 in the first instance, becomes in the second instance 18.000, namely excessively greater, so that the accurate working of the system, which would be already ensured without use of the differential device in the first case for a difference of 18, is ensured a fortiori in the second case for a difference of a thousand time greater.

The differential detecting device for exciting the clutches 49 and 50 is associated with the respective exciting circuits of the slow speed clutch 45 and the high speed clutch 47 so as to obtain the working of these clutches as for the right-hand displacement as for the left-hand displacement of the mechanism 16 of Fig. 5. In this purpose windings 63^l and 64^r supply with current, through respective windings 74 and 75, two rectifiers 76 and 77 in parallel connection in a circuit including a condenser 78 and a resistance 79, which circuit delivers, through the connection 80, the exciting current necessary to the high speed clutch 47. Likewise the windings 63^l and 64^r supply simultaneously, through respective windings 81 and 82, two rectifiers 83 and 84 in parallel connection in a circuit including a condenser 85 and a resistance 86, which circuit delivers, through the connection 87, the exciting current necessary for the slow speed clutch 45.

Instead of two photo-electric cells enclosed in receiving device for controlling the right-hand and left-hand movement of the orientable frame-work it is possible to utilize only one photo-electric cell associated with rotative obturating disc and a distributor. This modification is illustrated in Figs. 11 and 12. The orientable frame-work having any suitable form, is provided with an aperture in which is mounted the lens 4 for directing and condensing the incident beam 88 on a single photo-electric cell 89, through a rotative obturating disc 90. The latter, which is rotating by an electric motor not illustrated, is mounted within a follow ball bearing 91, the internal ball of which 91^1 is driven by the electric motor with help of a belt not illustrated; the external ball race is fitted in a support 92. The obturating disc 90 comprises a massive part occupying the most area of the disc and a perforated part 90^1 in sector form. The photo-electric cell 89 is facing to the disc and picks-up infra-red rays which are travelling through the sector aperture 90^1. This aperture, the surface of the photo-electric cell and the position of the same are arranged in such a way that said cell receives the infra red rays having passed through the aperture 90^1, whatever may be the position of this latter. The cell 89 is connected to an amplifier 93, the onput of which is connected to a rotative brush 94 fastened on a support 94^1 integral with the rotative disc 90 and driven simultaneously with him. The current is applied to the brush 94 through a fixed ring 95 upon which is rubbing another brush 94^2 fastened and electrically connected to the support 94^1. The brush 94 is rubbing upon fixed sectors 96, 97, 98 and 99 connected with a mechanism 100, which may be the mechanism 16 with clutches 27 and motor 28 illustrated in Fig. 5. This mechanism is fastened to the ship 101.

Normally, that is when the axis of the lens 4 coincides with the direction of incident infra-red rays, the image of the distant source is formed on the massive central part of the rotative disc 90, namely the part 102 illustrated in dotted line in Fig. 12. In these conditions no light impinges on the photo-electric cell 89 and no current is applied to the mechanism 100; the frame-work 1 remains in the desired position.

If, in consequence of any exterior impulse, such as the wind effect and the oscillations being transferred by indesirable friction to the mechanism 100, the frame-work 1 is rotating, or if the remote source is displaced, the image is no longer formed exactly at 102, but at a distance of this circle. At the instant when the sector 90^1 passes in front of the luminous spot formed by the image, the photo-electric cell 89 delivers a current which, after amplification, is applied to the mechanism 100 through either of connections 103, 104, 105 and 106, in accordance with the position of the luminous spot on the obturating disc 90. This, for instance, if the frame-work is pointed too high in relation to the direction of incident infra-red

rays 88, the image of the distant luminous source is produced underneath the circle 102, and when the aperture 90[1] is below, the photo-electric cell 89 furnishes a current. At this instant the brush 94 is rubbing on the fixed sector 98 and this current is applied to the mechanism 100 through the connection 105, which has as a result to make the axis of the optical system to turn towards the bottom and the luminous spot to move towards the circle 102. When the luminous spot has reached this circle 102, the current is interrupted and, at this instant, the frame-work is accurately pointed. If, on contrary, the frame-work is pointed too low in relation to the direction of incident infra-red rays 88, the image of the remote source produced by the lens 4 is over the circle 102, and when the sector aperture 90[1] passes at the top, the photo-electric cell delivers a current. At this instant the brush 94 is rubbing on the fixed sector 96, and this current is applied through the connection 103, to the mechanism 100, which moves the frame-work 1 until the luminous spot falls again on the circle 102. Similarly, if the direction of infra-red rays is too on the left or right in relation to the optical axis of the lens 4 the photo-electric cell delivers a current through either of sectors 97, 99, and either of connections 104 or 106, to the mechanism 100.

Thus the system maintains the axis of the optical device in coincidence with the direction of incident infra-red rays and consequently the frame-work 1 is continuously pointed on the distant luminous source.

Instead of using a gyroscope for ensuring the stabilization of the frame-work in a horizontal plane, it is possible to suspend the orientable frame-work by means of three axis perpendicular on each other, arranged in such a manner that the common intersection point forms the center of suspension, and one make this center of suspension to coincide with the center of gravity, so that the orientable frame-work is in indifferent equilibrium and totally insensible to ship acceleration. In these conditions the pointable frame-work is at all times horizontably maintained and photo-electric cells control the orientation in the manner above described and illustrated in fig. 5.

An example of such a suspension or triple cardan suspension is represented in fig. 13. The ship supports a pedestal base 107 terminated by a vertical spindle 108 around which a metallic mass 109 is pivoting in horizontal plane. This mass has a horizontal axis 110 which supports a frame 111 pivoting round said axis. This frame 111 has a horizontal axis 112 which supports a frame-work 113 pivoting round said axis 112. The axis of pivots 108, 110 and 112 are perpendicular to each other, and the frame-work 113 is for instance similar to the frame-work 1 of fig. 4. By suitable balancing, the center of gravity of the frame-work 113 is brought to pass through the intersection point of axis 108, 110 and 112, so that the whole remains in indifferent equilibrium. Advantageously this balancing may be obtained by a judicious arrangement of the projecting optical system and adjacent receiving optical system. Lenses of both optical systems are indicated by 4 and 12. In this embodiment, four photo-electric cells 114, 115, 116, 117 are conjugated to four mirors 118, 119, 120 and 121, as illustrated in fig. 14, in order to ensure the control of the frame-work 113 in all direction.

In the described examples of realization, one can take advantage of the automatic pointing of the frame-work on a moving distant projector, for determining in all times, the position and particularly the azimuth of this projector. For this purpose, with the frame-work is coupled, electrically or mechanically, an indicating instrument, the moving element of which, for instance a index or a luminous spot, will follow in front of a divided dial the movements of the frame-work and will indicate the position of same.

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Fig. 1

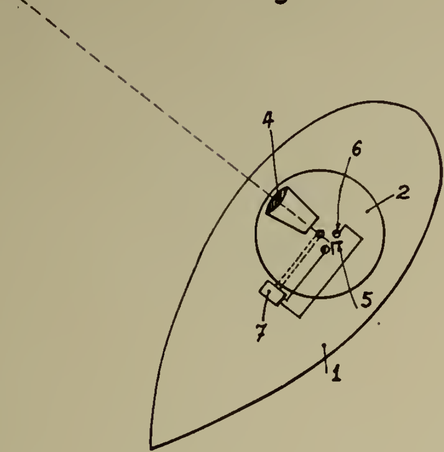

Fig. 2

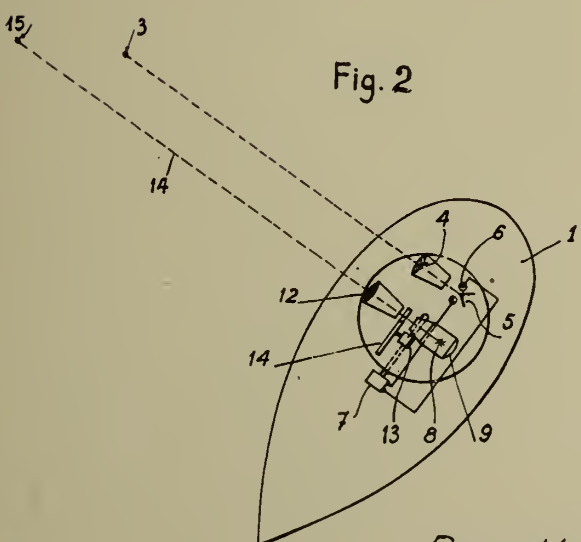

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Fig. 3

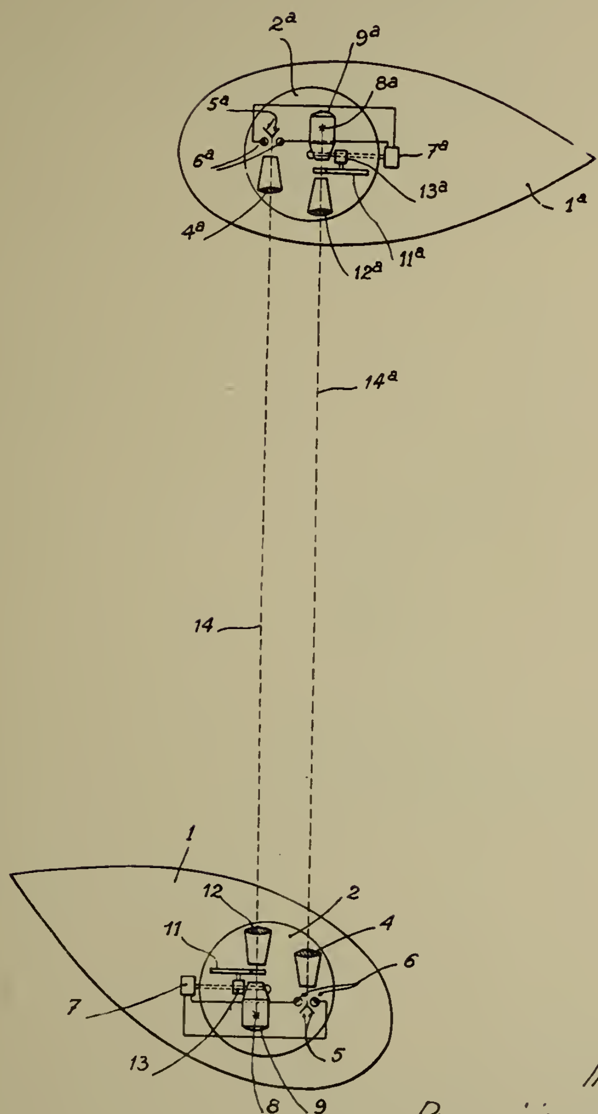

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Fig. 4

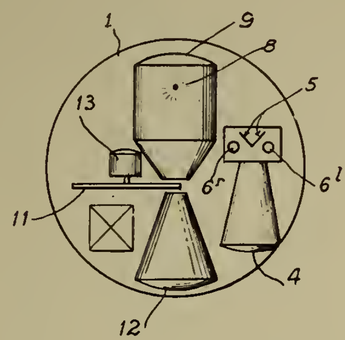

Fig. 5

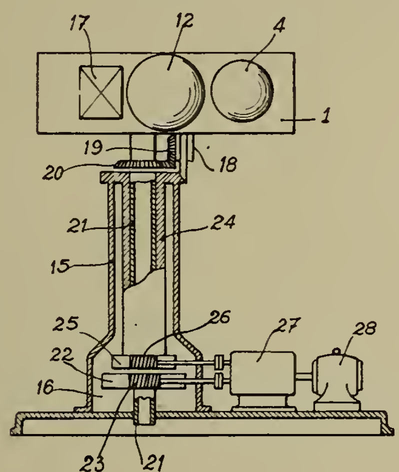

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Fig. 6

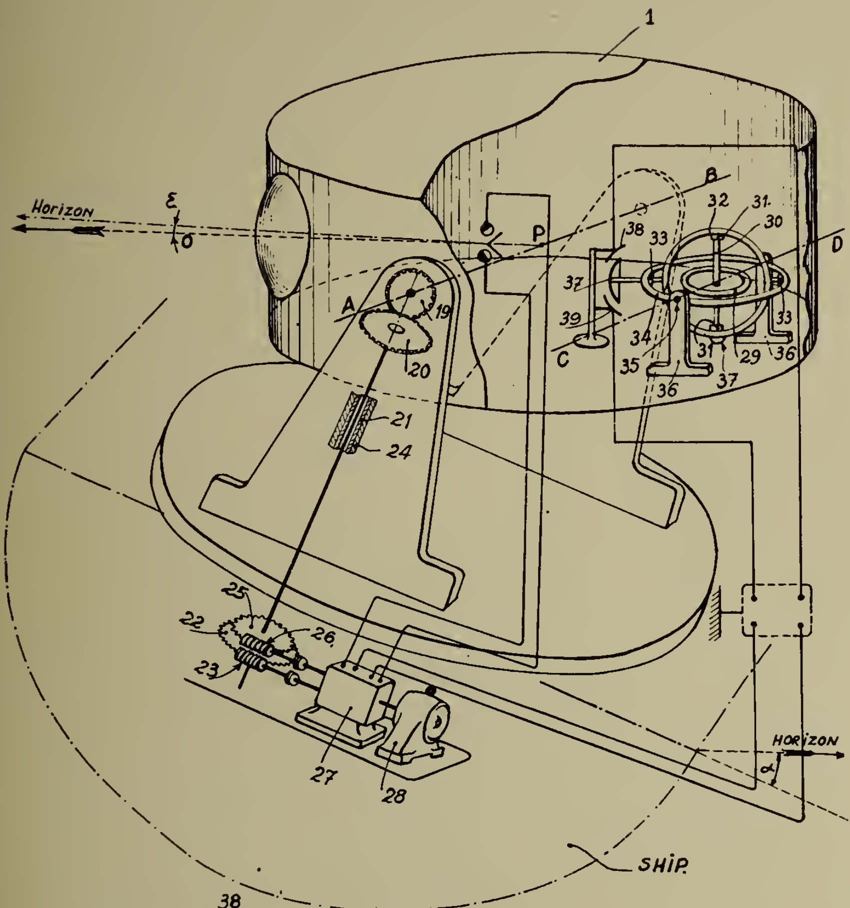
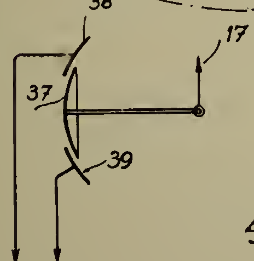


Fig. 7



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397,647
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Fig. 8

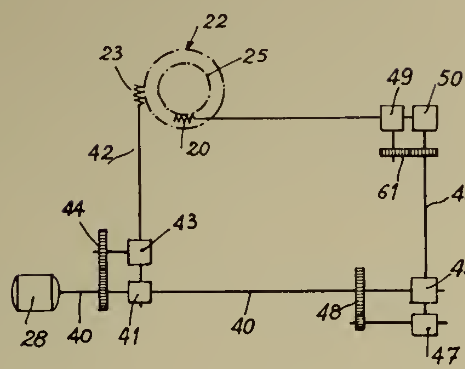
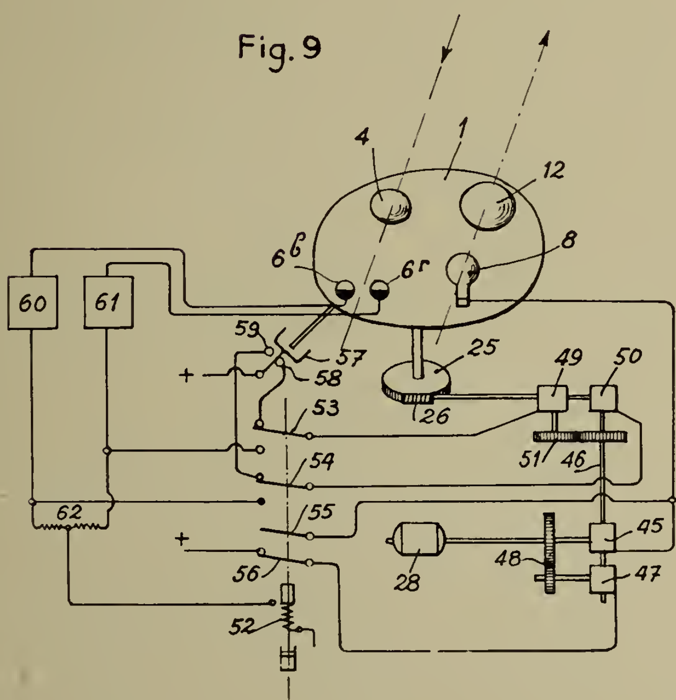


Fig. 9



INVENTOR
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by
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PUBLISHED
MAY 25, 1943.
BY A. P. C.

P. M. G. TOULON
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397,647
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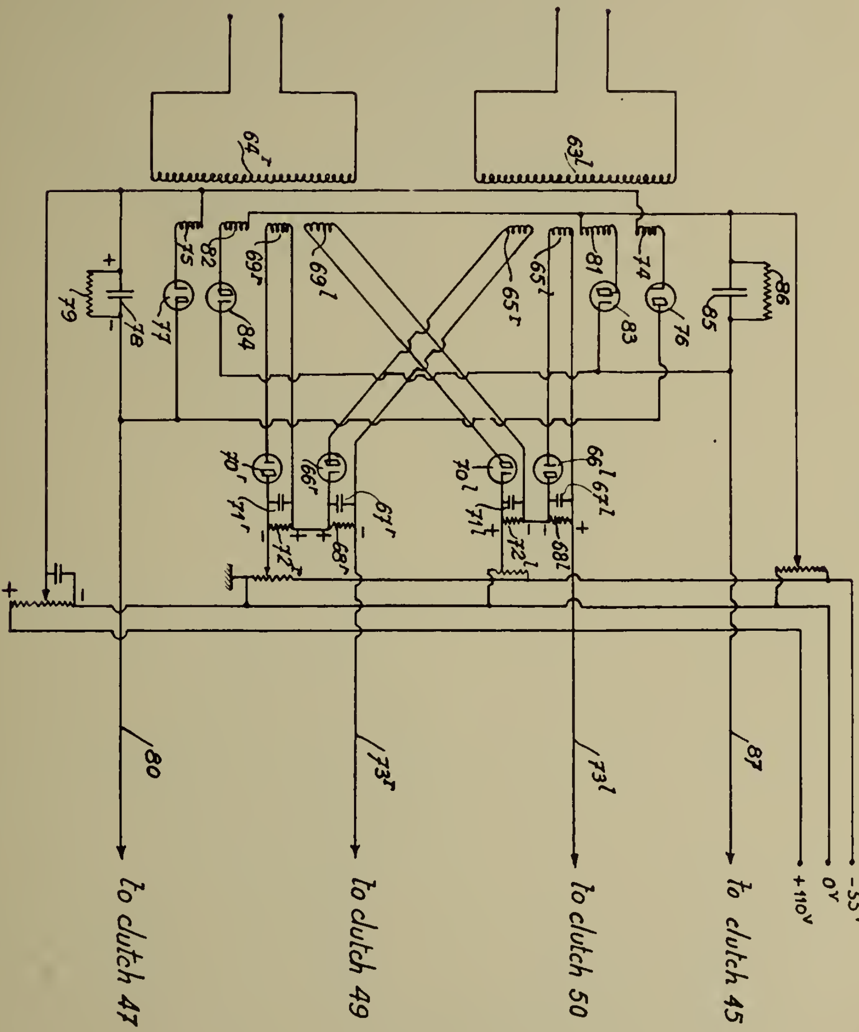

Fig. 10

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8 Sheets-Sheet 7

Fig. 11

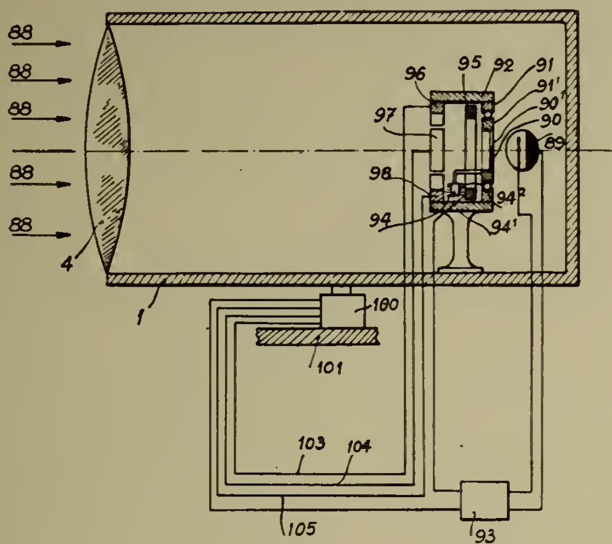
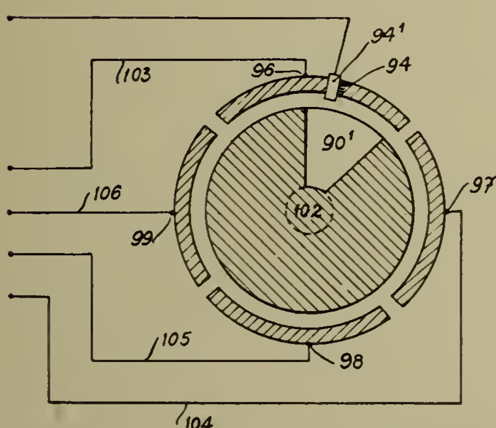


Fig. 12



INVENTOR
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BY A. P. C.

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Serial No.
397,647
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Fig. 13

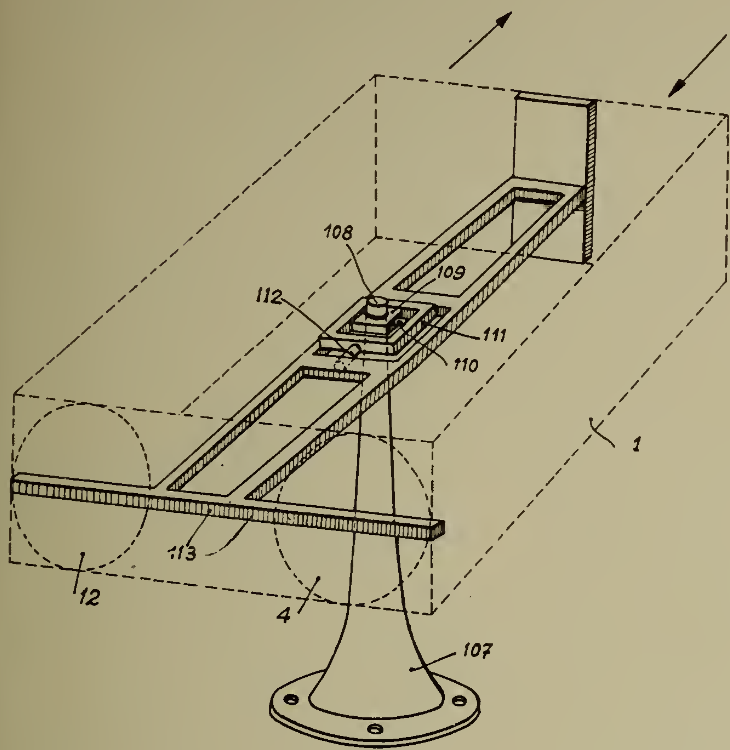
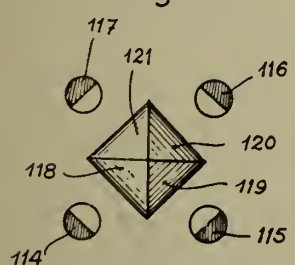


Fig. 14



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Published May 25, 1943

Serial No. 399,916

ALIEN PROPERTY CUSTODIAN

DEVICE FOR SINKING A DEEP OIL-WELL AND SIMULTANEOUSLY ELEVATING SANDS AND EARTHS

Shigeru Shinomiya, Tokyo, Japan; vested in the Alien Property Custodian

Application filed June 26, 1941

This invention relates to a device for sinking a deep oil-well and elevating sands and earths excavated from deeper stratum, and it comprises a pump cylinder, a piston in said cylinder, a tubular piston rod for said piston adapted for rotation in one direction as well as for reciprocation and having a drilling tool attached thereto and also provided with a spiral path in the hollow space therein for conveying sands and earths, and a system of pressure fluid for driving said piston rod and for conveying sands and earths discharged from said tubular piston rod.

The object of the invention is to provide a drilling device of simple construction and reliable operation and adapted for drilling in a deep stratum, not only in vertical direction, but also in any direction inclined to the vertical if desired, and for automatically discharging sands and earths excavated during the drilling operation, the sands and earths being elevated through the tubular piston rod.

In the accompanying drawings in which one embodiment of the invention is shown by way of example:

Fig. 1 is a longitudinal section of the device constructed according to this invention.

Fig. 2 is a similar section with the piston displaced, and

Fig. 3 is a side elevation of a modified form of the drilling tool attached to the lower end of the piston rod.

Referring to the drawings, 1 designates a pump cylinder, within which is sildably and rotatably mounted a piston rod 2 having a piston 3 securely mounted thereto. 4 and 5 are pressure fluid supply pipes. Communicating with the supply pipe 4 is a valve box 6, in which is provided a slide valve 7 adapted to alternately connect said pipe 4 with the opposite sides of the piston 3 through ports 8 and 9 respectively. The pipe 5 is connected alternately with opposite sides of said slide valve 7 in the valve box 6 through passages 10, 11 and 10', 11' respectively. On the other hand, the opposite sides of the valve 7 are alternately connected to a discharge pipe 13 enclosing the pump cylinder 1 through the passages 11', 12' and 11, 12 respectively. Thus, when the upper side of the valve 7 communicates with the supply pipe 5, the lower side of the valve 7 communicates with the discharge pipe 13 as shown in Fig. 1, and vice versa as shown in Fig. 2. The piston rod 2 is provided with two pairs of reduced portions 15, 16 and 15', 16' where it is passed through sleeves 14 extending from the cylinder ends. Said passages 10, 11, 12 and 10', 11', 12' open into the sleeve 14. Upon sliding movement of the piston rod 2, communication of the passages 10 and 11 through the reduced portion 15 (Fig. 1) and communication of the passages 11 and 12 through the reduced portion 16 (Fig. 2) are alternately effected. When, on one hand, the reduced portion 15 in the piston rod 2 connects the passages 10 and 11 to force the pressure fluid into the valve box 6, the reduced portion 16' on the other hand connects the passages 11' and 12' to permit the pressure fluid from the other side of the valve box 6 to pass into the discharge pipe 13.

Assuming that the piston 3 is in the position shown in Fig. 1, in which the pipe 5 is in communication with the upper side of the valve 7 in the valve box 6 through the passages 10, 11 and the upper reduced portion 15 in the piston rod 2, when the pressure fluid is supplied through the pipes 4 and 5, said fluid acts upon the upper side of the valve 7 pressing down the same, whereby the pressure fluid in the lower side of the vlave 7 is forced into the discharge pipe 13 through the lower passages 11' and 12' which are connected through the lower reduced portion 15' in the piston rod 2. By the downward movement of said slide valve 7, the pipe 4 is connected through the port 8 with the cylinder space and the pressure fluid acts upon the upper side of the piston 3 depressing same, and the fluid in the lower space in the cylinder is forced through the port 17 into the discharge pipe 13. Thus the piston 3 with the piston rod 2 moves to the position shown in Fig. 2. In this position, the relation between the pipe 4 and the cylinder 1 and the relation between the pipe 5 and the valve box 6 and the discharge pipe 13 will be reversed, so that the piston 3 is lifted. In such manner, the piston rod 2 is reciprocated downwardly and upwardly.

The piston rod 2 is made hollow, and it carries a drilling tool detachably attached thereto, which is adapted to be driven to the bed by the shock of the reciprocating movement. A sleeve 19 is provided surrounding the upper portion of the piston rod 2, in which the rod 2 is provided with a fixed collar 20 which is provided on both faces with claws 21, each having inclined side faces 22 at its tip. Secured to the ends of the sleeve 19 are saw-toothed guide members 23. Said guide members 23 are adapted, when engaged by the inclined side faces 22 of said claws 21 upon reciprocation of the piston rod 2, to impart a rotary movement to the piston rod in one direction. In the hollow space 24 of the

piston rod 2, there is provided a spiral path 25 adapted to convey the sands and earths upwardly upon the reciprocating and rotary movement of the piston rod 2. In an upper part of the piston rod tube 24, there are provided check valves 26 for preventing the back flow of the sands and earths. The upper extremity of the piston rod tube 24 is open into the discharge pipe 13, so that sands and earths discharged from the tube 24 are conveyed upwardly by the returning pressure fluid flowing through the pipe 13. 27 are check valves provided in the upper portion of the discharge pipe 13, which are adapted to prevent sands and earths from falling into the lower part of the discharge pipe when the operation of the device is stopped.

For the purpose of convenience of allowing the device to fall freely, the entire device is preferably enclosed within a stream-line shaped shell as shown in dotted lines 29.

For the sake of convenience, the terms "upper" and "lower" or "upwardly" and "downwardly" have been used in accordance with the showing of the drawings, but it should be understood that in practice the device is adapted not only for drilling in vertical direction, but also for drilling in any direction inclined to the vertical by being inclined or placed horizontally.

From the foregoing, it will be seen that, according to this invention, upon supply of pressure fluid the tubular piston rod is reciprocated and, at the same time, is rotated in one direction, so that the drilling tool attached to the lower end of the piston rod is adapted to effect drilling action, and sands and earths excavated are automatically elevated through the spiral path in the tubular piston rod by the reciprocating and rotary movement of the latter. The pressure fluid employed for driving the drilling tool is returned through the space surrounding the pump cylinder, and serves to convey outwardly said sands and earths discharged from the tubular piston rod. Thus, the drilling and discharge of sands and earths are simultaneously effected by a single system of the pressure fluid. By the employment of the pressure fluid, the motive power can be transmitted to a remote point, so that the device is adapted for drilling in a deep oil-well. It is adapted not only for sinking a shaft, i. e. drilling vertically, but also for drilling transversely at a deeper stratum by conveniently giving an inclination to the device.

If desired, as shown in Fig. 3, a drilling tool 28 which entirely closes the end of the tubular piston rod 2 may be used instead of the open bit 18 in the previous example. In this case, of course, sands and earths are not automatically elevated through the tubular piston rod 2.

SHIGERU SHINOMIYA.

PUBLISHED
MAY 25, 1943.
BY A. P. C.

S. SHINOMIYA

DEVICE FOR SINKING A DEEP OIL-WELL AND SIMULTANEOUSLY ELEVATING SANDS AND EARTHS

Filed June 26, 1941

Serial No. 399,916

Fig. 2.

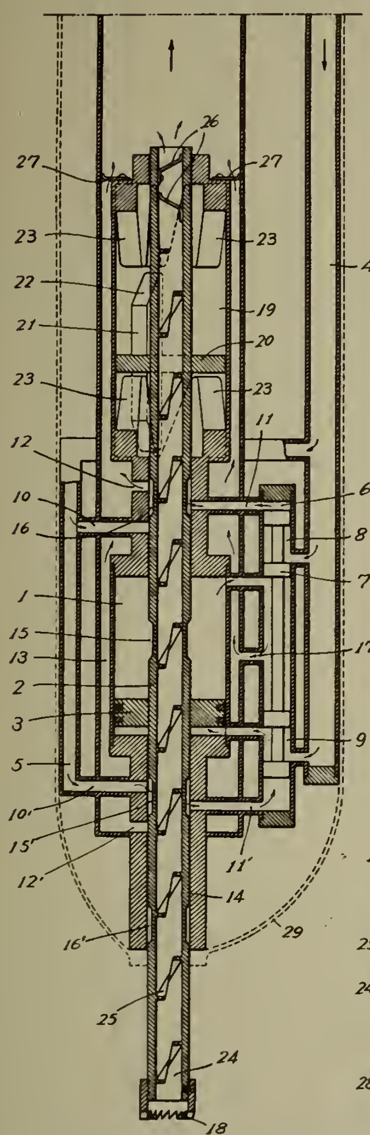


Fig. 1.

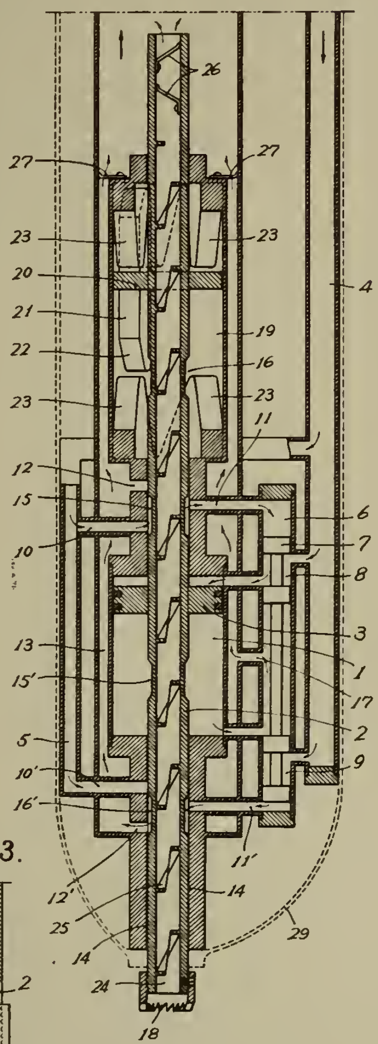
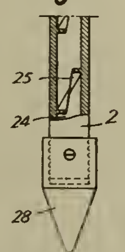


Fig. 3.



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Published May 25, 1943 Serial No. 399,917

ALIEN PROPERTY CUSTODIAN

DRILLING DEVICE CAPABLE OF ACTING TRANSVERSELY IN A DEEP OIL-WELL

Shigeru Shinomiya, Tokyo, Japan; vested in the Alien Property Custodian

Application filed June 26, 1941

This invention relates to a drilling device comprising a drive pipe, a flexible pipe extending therefrom and having a plurality of rings mounted around same at intervals, a plurality of longitudinal connecting strips detachably mounted between each two adjacent rings connecting the latter, a cable which is attached to the free end of said flexible pipe and is adapted of being actuated from outside for bending said flexible pipe where a portion of said longitudinal connecting strips are removed, and a drilling mechanism provided at the free end of said flexible pipe.

The object of the invention is to provide a novel drilling device which is capable of being bent at predetermined point in predetermined direction in a deep oil-well by merely pulling a cable from outside the ground, so that it is possible to effect transverse drilling at a point in stratum of desired depth.

In the accompanying drawings in which one embodiment of the invention is shown by way of example:

Fig. 1 is a side elevation of the device according to this invention,

Fig. 2 is a similar view with a portion broken away,

Fig. 3 is an enlarged fragmental view,

Fig. 4 is a perspective view showing one of the rings used in this device, and

Fig. 5 is a perspective view showing one of the longitudinal connecting strips.

Referring to the drawings, 1 designates a vertical drive pipe having connected thereto a lower extension comprising a flexible pipe 2 which consists, for example, of a spirally wound steel strip. Around said flexible pipe 2, there are mounted at desired intervals a plurality of rings 3. Adjacent two rings 3 are connected by means of a plurality of longitudinal connecting strips 4. Each connecting strip 4 is provided at its ends with holes 6, and is mounted to the rings 3 by means of bolts 5 fixed to the rings 3 and nuts 7. A cable 8 is attached to the free end of the flexible pipe 2, and is extended to the outer end of the driving pipe 1 after being passed around a guide pulley 9. There is also provided a drilling means *a* inserted in the free end of the flexible pipe 2, and a driving device (not shown) is enclosed within the pipe.

The operation of the device according to this invention is as follows:

At any position of the flexible pipe 2 where it is desired to be bent, the longitudinal strips 4 which lie along the inner and outer sides of the curvature to be formed are all removed, leaving other longitudinal strips 4 which lie in the opposite side faces as shown in Fig. 3. Then, the entire pipe is allowed to fall freely through a shaft as shown in dotted lines A. At the desired depth, the cable 8 is pulled from above the ground. Thus, the flexible pipe 2 is bent at the predetermined point in the predetermined direction, the remaining portions of the flexible pipe being held straight. The drilling operation is proceeded in any transverse direction by gradually varying the angle of bent by pulling the cable 8. By rotating the driving pipe, the drilling may be proceeded in different planes. Dotted lines B show an intermediate bent position of the flexible pipe.

According to this invention, at the desired portion of the flexible pipe to be bent, the longitudinal connecting strips 4 which prevent flexing of the pipe are all removed, leaving the other strips 4 which do not prevent such flexing. After inserting the entire device into the shaft, the flexible pipe 2 can be bent at predetermined point in predetermined direction by pulling the cable 8 from outside the ground, and the remaining portion of the flexible pipe is held straight, so that it is possible to effect transverse drilling at any desired deep stratum.

SHIGERU SHINOMIYA.

PUBLISHED

MAY 25, 1943.

BY A. P. C.

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DRILLING DEVICE CAPABLE OF ACTING
TRANSVERSELY IN A DEEP OIL-WELL
Filed June 26, 1941

Serial No.
399,917

Fig. 1.

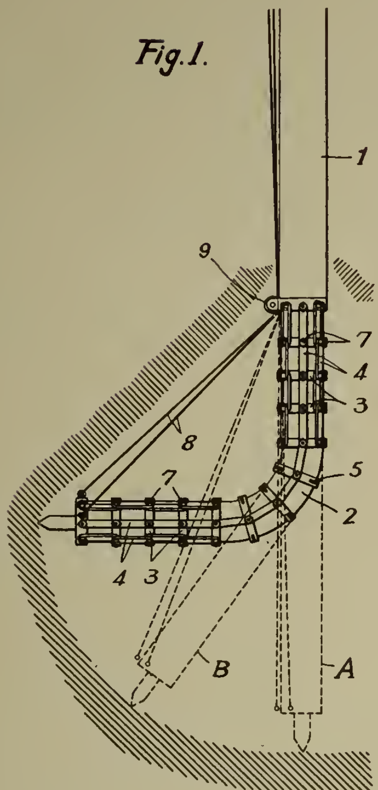


Fig. 2.

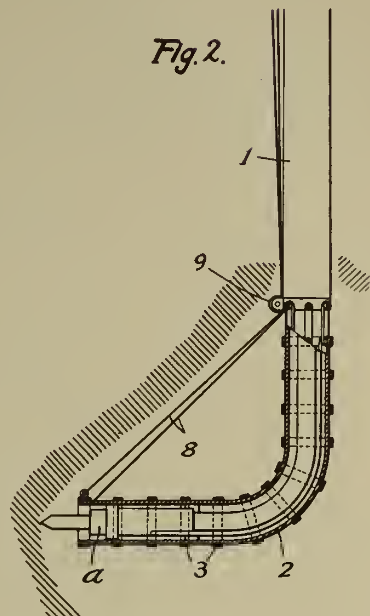


Fig. 3.

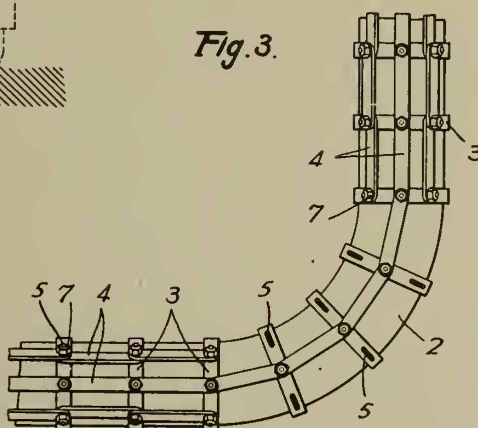


Fig. 4.

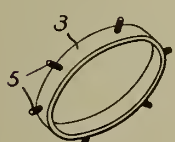
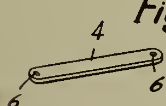


Fig. 5.



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Published May 25, 1943 Serial No. 400,879

ALIEN PROPERTY CUSTODIAN

BAG

Adolf Rambold, Dresden A, Germany; vested in the Alien Property Custodian

Application filed July 2, 1941

This invention relates to bags, which may be perforated and utilised as infusion packages, or which may be imperforate and utilised as sales packages.

An object of the invention is to provide a new and improved bag in which a tight seal is obtained without the use of adhesive.

A glueless bag in accordance with the invention is made from an integral blank of material comprising a smooth continuous bottom and at least two opposite smooth continuous sides, at least two other sides being formed by folded lateral portions of said continuous sides, an outer portion of the bottom being thrust between each two of said lateral portions, said outer portion of the bottom being over-and-over folded together with said lateral portions, the edge of said outer bottom portion being retained near the edges of the adjacent lateral portion thereby automatically to form when folded a tight seam.

The method of making the bag comprises folding the blank into substantially U-shape to form a smooth continuous bottom for the bag, thrusting each outer portion of the bottom up between the adjacent lateral portions, locating and maintaining the edge of each outer bottom portion near the edges of the adjacent lateral portions, folding said lateral portions and the intervening outer bottom portions over and over upon themselves automatically to close the seams, and flattening each of the folded portions.

The invention further consists in doubly securing a holder string to the bag by the clamping action of a staple, for which purpose the end of the string is placed over the edge of the bag loop-fashion and is gripped by the staple at two points. A notch may be provided in the edge of the bag for guiding and securing the holder string.

In order that the bag may be utilised as an infusion package, it is necessary that liquid may pass therethrough, and if it is not inherently pervious, as are for example fabric materials, it is provided with apertures. For example, the bag may be perforated in known manner.

An advantage of the invention is that the adhesives hitherto utilised for forming bags or infusion packages are avoided, thereby making it possible to form a cheap packing harmless for the contents.

Various embodiments of the invention are illustrated in the accompanying drawings.

Fig. 1 shows how that portion of the bag bottom projecting over the ground area is to be thrust between the projecting ends of the side walls to be folded flat on to the core.

Fig. 2 shows part of the completed bag as seen from the inside.

Fig. 3 represents a sales bag in accordance with the invention.

Fig. 4 illustrates an infusion bag.

Fig. 5 shows diagrammatically part of a bag in plan in unfolded condition, but with the folding lines indicated.

Fig. 6 is a front elevation of the bag, after the narrow side walls have been formed.

Fig. 7 is a side elevation corresponding to Fig. 6.

Fig. 8 shows the bag in bottom plan view, the folding being completed at one side.

Fig. 9 is an elevation corresponding to Fig. 8.

Fig. 10 is a side elevation of the finished bag, part being broken away.

In the production of the bag a rectangular blank is utilised, which is folded in known manner, namely U-fashion, upon a rectangular core.

The bottom of the bag to be produced is indicated at **1**. Integral parts of the bottom projecting at the two narrow sides are indicated by the reference numerals **2** and **3**, while the portions of the blank which are folded up from the bottom are indicated at **4** and **5**. From the figures it will be clear that the part **2** of the bottom which extends beyond the base area of the bag is thrust upwards between the laterally projecting edges of the upstanding walls **4** and **5** which are to be folded together on to the core. An inner triangular portion of the projecting base is pressed upwardly towards the core while the remainder of said projecting base is doubled upwardly upon itself into parallelism with the laterally projecting upstanding walls, the edge of each outer base portion being retained near the edges of the laterally projecting upstanding walls. Consequently when these walls are folded together twice for forming a tight side seam the bottom portion **2** located between them is folded twice therewith. The same applies to the bottom portion **3**. The folding lines are indicated at **6**, **7** and **8**. It is noteworthy that the lower edge **9** of the folding (Figs. 9 and 10) is nearly level with the bottom **1** of the bag.

The bag so made may be stapled, care being taken that the staples are applied at points where as many layers of material as possible may be gripped by them (see for example the staple **10** in Fig. 10).

Adequate tightness of sealing is obtained owing to the fact that the upturned bottom flaps **2** and **3** (as clearly shown in Fig. 6) extend substantially to the outer edge of the sides to be folded together.

In order to provide an absolutely safe seal at the top closure, staples 18 (Fig. 4) are employed. In this connection care must be taken that the longitudinal fold is engaged by the outermost staples. By the double top fold, which is secured in position by means of staples, a perfectly tight sealing down of the bag is assured. The staples 18 may also be utilised for fixing a label string 19, or for fixing a handle formed of a string and running from one outer staple to the other.

The holder string is preferably fixed by placing one of its ends loop-fashion over the edge of the bag and gripping it by a staple at two points, whereby safe connection is assured between the string and the bag.

If it is required to pass the string round the bag, a notch is provided at the top folding, preferably above the stapling of the edge of the bag, in which the other end of the holder string may be detachably fixed. The notch must be so disposed that the seal of the bag is not damaged and the contents thereof cannot escape. This arrangement gives the assurance that the string, particularly if it is provided with a label and if this is pushed under the string loop, retains its position.

If the bag described, which is preferably made of cellulosic material, is utilized as an infusion package, it may be provided in known manner with holes 20 (Fig. 4), which are adapted to permit entry of the water and "drawing" of the contents.

ADOLF RAMBOLD.

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MAY 25, 1943.
BY A. P. C.

A. RAMBOLD

BAG

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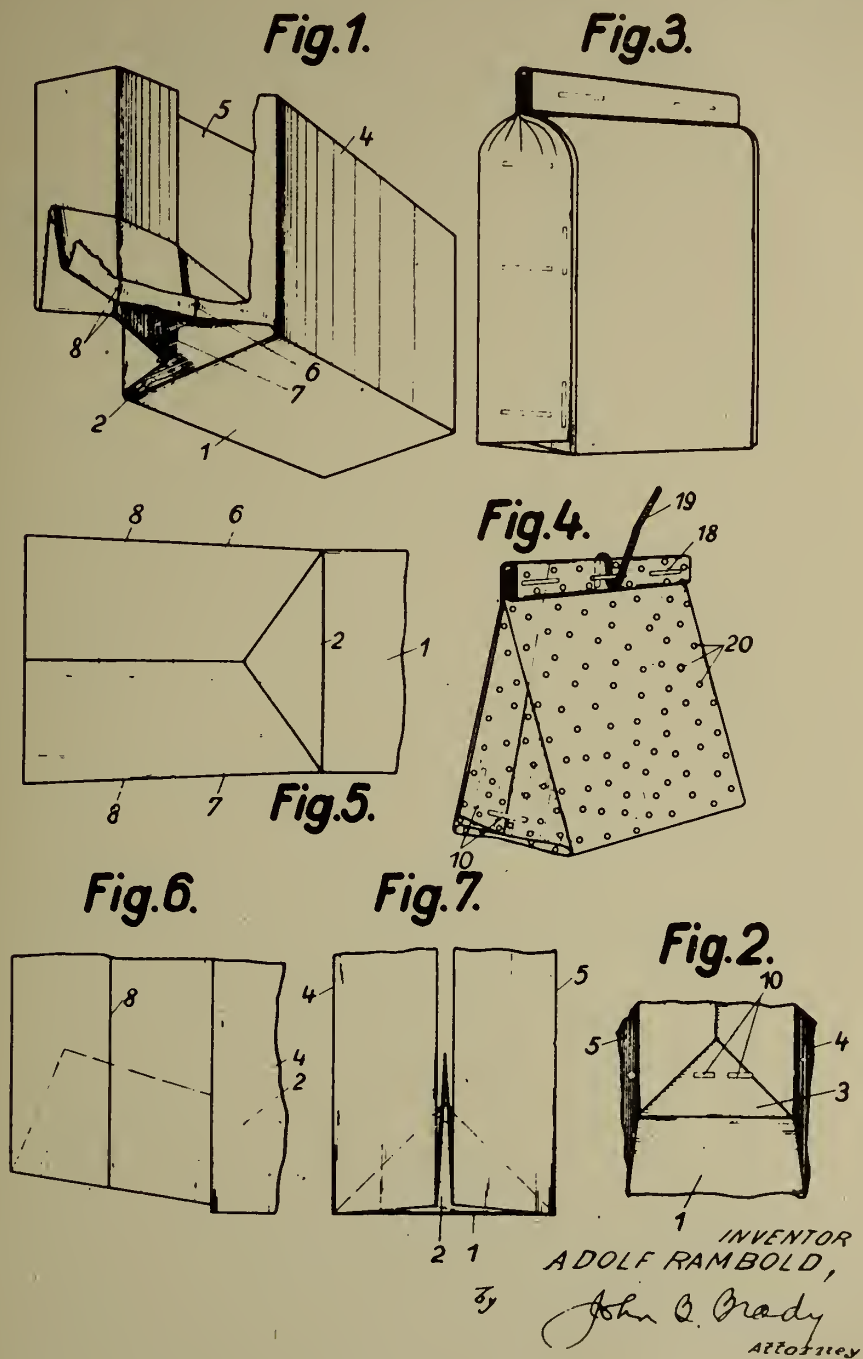
2 Sheets-Sheet 1



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BY A. P. C.

A. RAMBOLD
BAG
Filed July 2, 1941

Serial No.
400,879
2 Sheets-Sheet 2

Fig.8.

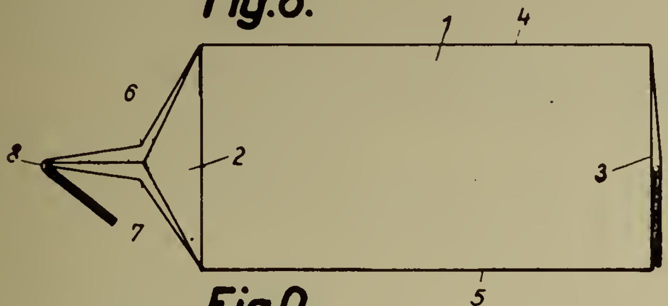


Fig.9.

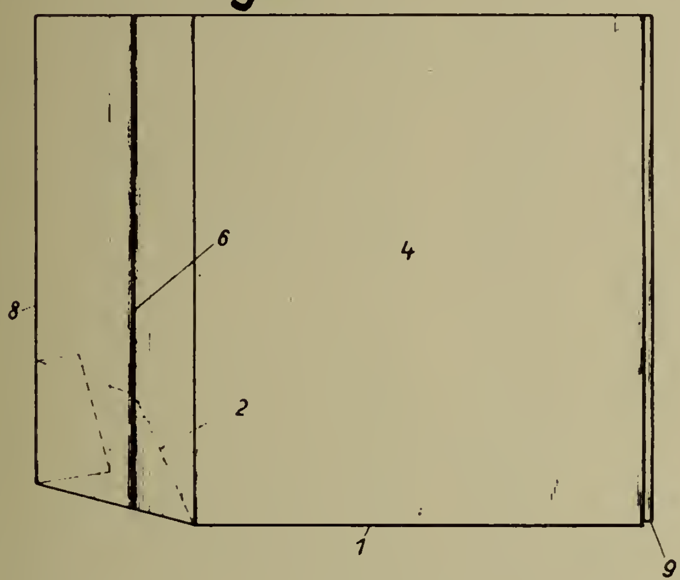
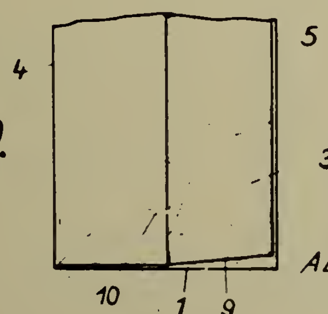


Fig.10.



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John B. Brady
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Published May 25, 1943

Serial No. 401,038

ALIEN PROPERTY CUSTODIAN

DEVICE FOR THE PRODUCTION OF VISIBLE OR PHOTOGRAPHIC IMAGES WITH EMPLOYMENT OF NEUTRONS AS DEPICTING RADIATION

Hartmut Israel Kallmann, Berlin-Charlottenburg, and Ernst Kuhn, Berlin N 65, Germany; vested in the Alien Property Custodian

Application filed July 3, 1941

A device for the production of visible or photographic images of objects with employment of neutrons as depicting radiation has been proposed, in which in a neutron-reactive layer heavily charged particles or electrons are produced by the depicting neutrons, and these charged particles or electrons release in the neutron-reactive layer or in a neighbouring layer slow electrons, which are accelerated by electric fields and, after they have passed through an electron-optical system, produce a picture on a luminescent screen or on a photographic layer. With this device it is possible to produce pictures very rich in contrast even with a neutron radiation of low intensity.

At the production of such neutron-image-converter difficulties are caused under circumstances thereby that the neutron-reactive layer and the layer from which the slow electrons are released react the one with the other in undesired manner during the production of the image-converter, for instance at the baking out of the vacuum tube. Some neutron-reactive layers also partly lose their efficiency at the heating to higher temperatures which for the object of baking out can be hardly avoided in the course of the production of the image-converter.

It is an object of the present invention to obviate these difficulties involved in the production of the apparatus formerly described. For this and other inventive purposes the neutron-reactive layer is applied outside the vacuum space, and at this point the wall of the vessel is made such that it lets pass through the radiation serving for the releasing of the slow electrons.

In a neutron-image-converter, in which the heavily charged particles or electrons produced in the neutron-reactive layer by the depicting neutrons release in a neighbouring luminescent mass a radiation, which in turn only releases slow electrons in a neighbouring layer, it is advisable to provide under certain circumstances in the arrangement according to the invention also the luminescent mass outside the vacuum tube. For intensifying the effect, a surface, which reflects the radiation emitted by the luminescent mass and lets pass through the charged particles exciting the luminescent mass, is preferably provided on the side of the luminescent mass remote from the vacuum space.

For reducing unsharpness and losses from reflection on the wall of the tube, it is advisable to apply directly upon the wall the neutron-reactive mass or the luminescent mass, or, if desired, both masses mixed.

If in the neutron-reactive mass electrons are produced which in turn have to release slow electrons in the interior of the vacuum space from another layer, the wall of the tube at this point must let pass the electrons released from the neutron-reactive layer.

Some substances for the neutron-reactive layer, for instance metallic lithium, are especially affected by moist air, so that their efficiency decreases gradually. For increasing their durability it is therefore advisable in such masses for neutron-reactive layers and similar sensitive luminescent masses, to house the neutron-reactive mass, if desired together with the luminescent mass and the reflecting layer, in the interior of a closed space adjoining the wall of the vacuum tube, said space being evacuated or filled with a gas which does not affect said substances.

Embodiments of the arrangement according to the invention are shown partly in diagrammatic illustration in the figures of the accompanying drawing.

The neutron beam 2 serving for depicting starts from the source of neutrons 1 and traverses the body 3 to be depicted. The depicting neutron radiation 4 impinges upon the neutron-reactive layer 5 arranged outside the vacuum space and produces in this layer heavily charged particles or electrons. The intensity of the thus produced heavily charged particles or electrons is different from place to place according to the neutron radiation locally weakened by the body 3 to be depicted. The heavily charged particles or electrons release in and adjacent 6 of luminescent mass a radiation, which passes through the wall 7 of the tube, which at this point lets pass radiation, into the vacuum space and releases there slow electrons from a photo-sensitive layer 8. These slow electrons are accelerated and can be collected electron-optically in a manner known per se upon an luminescent screen or upon a photographic layer to produce an image of the object.

Between the layer 6 of luminescent mass and the neutron-reactive layer 5 a reflecting surface 9 may be provided for intensifying the effect, said surface reflecting the radiation emitted by the luminescent mass through this mass itself into the interior of the vacuum space upon the photosensitive layer. This surface 9 lets pass through the heavily charged particles or electrons produced by the neutron in the layer 5.

The luminescent mass and the neutron-reactive layer mass may be applied directly onto the

wall 7 of the tube the one mixed with the other as well as singly.

The wall must be such that it lets pass through electrons at 7 in case electrons are emitted from the neutron-reactive layer 5 which, in the form of construction shown in Fig. 2, is directly adjacent to the wall, said electrons having to release slow electrons from the layer 8 which is in the interior.

In the embodiment shown in Fig. 3, the neutron-reactive layer 5, inclusive the luminescent mass 6 and the reflecting layer 8 are housed in the interior of a space closed by a cap 10, said space being directly adjacent to the wall and evacuated or filled with a gas which does not affect the said masses.

Another advantage of the arrangement according to the invention consists in that, without alteration of the evacuated image-converter-tube, the neutron-reactive layers in which the heavily charged particles or electrons are produced by the depicting neutrons can be exchanged. It is therefore possible to make preferably reactive the device for neutrons of different speed with the same image-converter-tube merely by exchanging the neutron-reactive layers or luminescent masses arranged on the outer side.

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PUBLISHED

MAY 25, 1943.

BY A. P. C.

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DEVICE FOR THE PRODUCTION OF VISIBLE OR PHOTOGRAPHIC IMAGES WITH EMPLOYMENT OF NEUTRONS AS DEPICTING RADIATION

Filed July 3, 1941

Serial No. 401,038

Fig. 1.

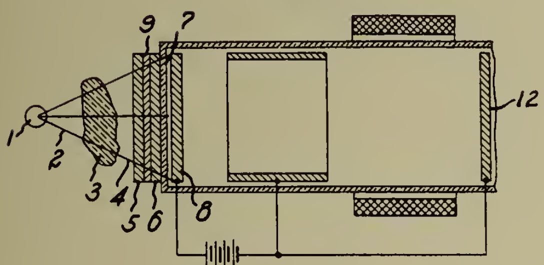


Fig. 2.

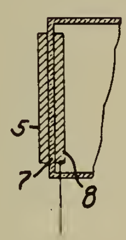
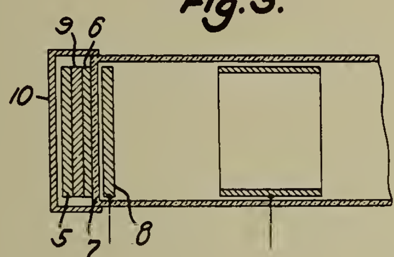


Fig. 3.



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ALIEN PROPERTY CUSTODIAN

METHOD AND DEVICE FOR DEPICTING OBJECTS BY MEANS OF NEUTRONS OR X-RAYS

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Application filed July 3, 1941

It has been proposed to depict objects by means of neutrons in a similar manner as it is known from X-rays. The difficulty consists, however, that the sources of neutrons which are at disposal possess only a slight intensity in proportion to the possibility to blacken a photographic layer by means of neutrons, so that even with the best neutron-photographing systems known at the time, it is necessary to expose for a comparatively long time. Increasing of the intensity of the source of neutrons, which would be possible in principle, is connected with a very considerable technical expense and requires besides very much space. It has further been proposed, to use for the production of photographic pictures of objects by means of neutrons a neutron-image-converter, in which in a neutron-reactive layer by the neutrons depicting the objects charged particles or gamma rays are released, which produce secondary electrons directly or indirectly through the intermediary of a luminescent mass, said secondary electrons being accelerated and collected with the aid of suitable electron-optical means upon a photographic layer where they produce an image of the depicted object. It has also been proposed, to collect, for increasing the sensitiveness of this image-converter, these electrons not directly upon a photographic layer but upon a luminescent screen, the radiation of said screen emitted under the influence of the impinging electrons acting upon the photographic layer. However, even if these special auxiliary means are employed, a comparatively intensive source of neutrons is still required if the picture has to be produced within a few minutes with sufficient sharpness.

It is an object of the present invention to overcome this drawback. This and other inventive purposes are attained thereby that in the neutron-image-converter the released secondary electrons, preferably after their acceleration, are collected by electron-optical means to form an image of the object to be depicted reduced in size on an luminescent screen and/or on a photographic layer and that this image reduced in size is enlarged to a real or virtual image under circumstances after the latent photographic image has been developed. It is then advisable to adjust the image-converter, so that the originally slow secondary electrons are preferably employed for the copying. At the electron-optical reducing neither a loss in intensity nor a loss in sharpness of the picture occurs. At this reducing practically all secondary electrons are employed which are emitted to one side. In opposition here to at a light-optical reduction only that portion of the light radiation is utilized, which enters into the lens aperture. At the electron-optical reduction the brightness per unit area is therefore practically inversely proportional to the size of the image. The strongly reduced image produced in this manner is preferably light-optically enlarged. If a latent photographic image reduced in size has been produced with the image-converter, the enlargement will be carried out after the development of the latent photographic image, for instance to the size of the latent image originally produced by the neutrons. The enlarged image possesses the same sharpness as the image which has been produced on an luminescent screen and/or on a photographic layer according to the methods formerly proposed. The exposing time necessary in the method according to the invention for the production of a photographic image is, however, for instance with a linear reduction in the proportion 1:10, hundred times shorter than in the formerly proposed methods. When retaining the time of exposing, it is therefore possible to use in the application of the method according to the invention a source of neutrons the intensity of which amounts to only $\frac{1}{100}$ of the intensity of the source of neutrons necessary in the former methods.

This advantage of the method according to the invention is due amongst other reasons to that the reduced photographic image is subsequently enlarged by an additional source of energy, such as for instance the source of the light-optical enlarging arrangement which is absolutely independent on the source of neutrons. If the sharpness of the original image produced by the neutrons has to be preserved, the measure of the reduction and therewith the gain in intensity is practically limited by the dissolving power and the structure of the photographic system.

This method may also be employed for improving the visual observation of a luminescent screen image produced by means of the neutron-image-converter. The latent image primarily produced by the neutrons on the neutron-reactive layer is reduced and copied in the neutron-image-converter on a luminescent screen, and this reduced luminescent screen image is viewed through a magnifying glass. By viewing the luminescent screen image through a magnifying glass much more light will get into the eye from the locked on portion of the luminescent screen image than without magnifying glass, owing to the enlargement of the opening angle. For the reason that

by the image converter the whole image can be reduced to the size of the field of vision of the magnifying glass, a larger portion of the light emitted by the luminescent screen gets into the eye, without decrease of the sharpness of the virtual picture.

Owing to the above mentioned reasons, the method described is very important for the depicting of objects by means of neutrons. Under certain circumstances it may, however, be employed also with advantage at the depicting of objects with the aid of X-rays can be produced nowadays up to very great efficiencies, but on the other hand the requirements as regards thickness of the objects to be depicted are also increased more and more, so that the exposing times are undesirably long even when the strongest transportable plants are used which are at disposal. In such conditions an X-ray-image-converter is used in which secondary electrons are released by the X-rays themselves, said secondary electrons being collected to form a luminescent screen- or latent photographic-image of the object to be depicted reduced in size, which reduced image is enlarged just as described in the case of the depicting by means of neutrons.

Two embodiments of the invention are diagrammatically shown by way of example in the accompanying drawing.

As shown in Fig. 1, the object 2 diagrammatically represented by an arrow is latently depicted on the neutron-reactive layer 3 by a source 1 of neutrons. The latent image 4 is, as regards size, as a rule not considerably different from the object 2. It is, however, also possible, with the arrangement shown, to produce on the reaction layer enlarged images of the object 2 when the distances between the source of radiation the object and the reaction layer are correspondingly selected. Charged particles or gamma rays are produced by the depicting radiation in the reaction layer 3, said particles or gamma rays releasing directly or indirectly secondary electrons in this reaction layer 3 or in an adjacent layer 5. These secondary electrons released from this layer 5 or from the layer 3 are accelerated by the electric field between the layer and the electrode 6 and electron-optically collected in known manner on the electronsensitive screen 7 to produce an image of the object 2. This screen 7 may consist of a luminescent screen on which the impinging electrons produce a luminous image of the object. By corresponding selection of the electron optical system, for instance of the magnetic lens 8, care is taken according to the invention that the image 9 of the object produced on the screen sensitive against electrons is much smaller than the latent image 4, which is produced in the reaction layer and as regards size corresponds substantially to the object to be depicted.

Through the wall 10 of the tube transparent at least behind the screen 7 and consisting for instance, of glass, a strongly enlarged virtual image 12 is produced with the aid of the magnifying lens 11, this image being viewed by means of the eye 13 which is diagrammatically shown.

Instead of the screen 7 just described and sensitive against electrons, which consisted of a luminescent screen, a photographic system may also be employed, on which in a similar manner a reduced latent photographic image 9 of the object 2 is produced. This image can be looked at only after the developing. With this object in view either a magnifying lens may be employed with the aid of which, as shown in Fig. 1, a virtual image is produced, or an enlarging arrangement may be used, which is diagrammatically illustrated in Fig. 2. By a source of energy 14, preferably independent on the source for the production of the depicting radiation, the developed reduced image 16 is exposed, if desired by interposition of a lens 15, and from this reduced image an enlarged real or virtual photograph 18 is produced by means of the enlarging light-optical system 17.

The production of the latent photographic image 9 by the secondary electrons released from the layers 3 or 5 may also be obtained by the circuitous way of a luminescent screen adjacent to a photographic layer. In this instance the electron-sensitive screen 7 is composed, as shown in Fig. 3, of two layers, i. e. a luminescent screen 19 on which the electrons act and a photographic layer 20.

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Fig. 1

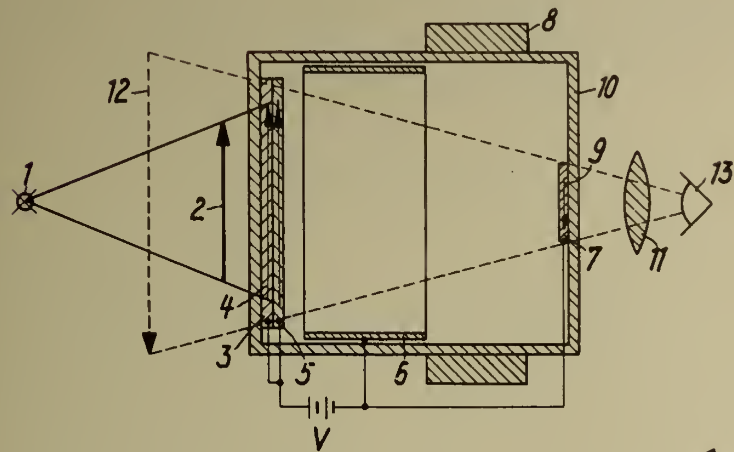

Fig. 2

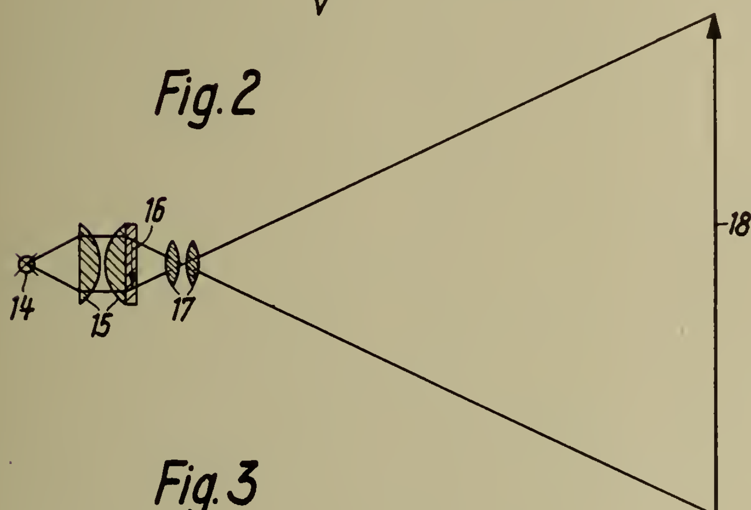

Fig. 3

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ALIEN PROPERTY CUSTODIAN

TRANSMITTERS FOR TESTING RADIO RECEIVERS

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Application filed July 5, 1941

For testing direction finding receivers and the like a small measuring transmitter has to be erected on the test floor. This transmitter is arranged to radiate a nearly constant field intensity in order to provide for testing the compensation of site error and for ascertaining the direction finding properties of the receiver. For this purpose it has been necessary continually to supervise the frequency and field intensity of such tests transmitter because supply lines from the receiver to the transmitter are not permissible. The frequency of the transmitter must be changed in accordance with instructions called at an attendant.

A test transmitter as provided by the present invention does not require any manipulation other than erecting and energizing it and then nevertheless radiates a constant field intensity for the fundamental frequency and harmonics thereof.

To such end an amplifying tube is used and the anode current thereof is made to be saw-tooth-shaped. In order to achieve this the control frequency of the testing transmitter is conveyed to the amplifying tube at an amplitude which is sufficiently great, while also the grid condenser and the grid leak resistance of such amplifying tube are properly calculated. As a result, with a certain anode loading resistance there will be effective at the antenna condenser the fundamental wave and harmonics which are the more numerous the steeper the descending flanks of the saw teeth. The amplitude of the harmonics decreases when the ordinal thereof increases. Contrary to this phenomenon the radiation of a short bar-shaped antenna increases with the frequency increasing in its turn. Therefore, according to other features of the invention the amplitude, which decreases when the ordinal of the harmonics increase, is so balanced by properly tuning the antenna, that the antenna shall radiate a constant amplitude for the fundamental wave and a number of harmonics.

In the drawing, Fig. 1 is a diagrammatic view showing one embodiment of the invention, Fig. 2 is a graph of the anode current of tube **2**, Fig. 1.

The arrangement illustrated in Fig. 1 is the customary control transmitter which also may be variable. **1** denotes the oscillatory tube, **2** the amplifying tube, R_G the grid leak resistance, C_1 the grid condenser for tube **2**. According to the invention, R_G and C_1 are so chosen that the anode current JA of tube **2** is saw-tooth-shaped, as illustrated in Fig. 2. This anode current has the fundamental frequency of the control transmitter. With a certain anode resistance R_a, there are effective at the antenna condenser C_2 the fundamental wave and harmonics which are the more numerous the steeper the descending flanks of the saw teeth represented in Fig. 2.

If the antenna be $\lambda/4=2.5$ m long, λ being the wavelength, then its best efficiency is obtained in the case of $\lambda=10$ m. Furthermore, if the fundamental frequency of the control transmitter be 1 MHz, that is, one million cycles per second, it will be possible to insure a fairly constant field intensity of the test transmitter within a range that includes the 25th harmonic. The transmitter thus operates within the entire necessary frequency range, say from 100 m down to 10 m, at a field intensity which is constant for distances of 100 kHz, 500 kHz or 1000 kHz.

No attendance to such test transmitter is necessary during operation.

Transmitters of this kind are intended especially for testing the reception of short waves.

KURT KOSCHMIEDER.

PUBLISHED K. KOSCHMIEDER Serial No.

MAY 25, 1943. TRANSMITTERS FOR TESTING RADIO RECEIVERS 401,099

BY A. P. C. Filed July 5, 1941

FIG.1.

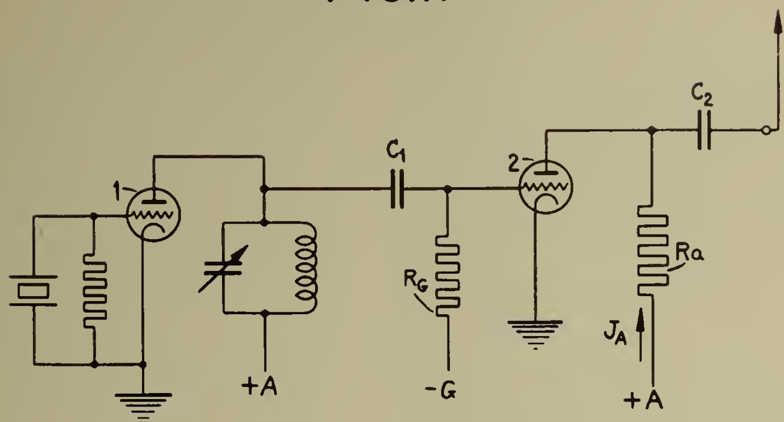
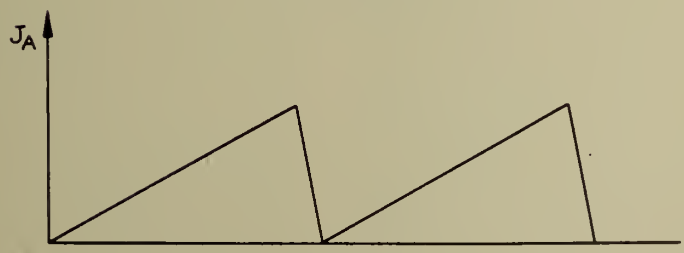


FIG.2.



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ALIEN PROPERTY CUSTODIAN

ARRANGEMENT TO DISCONNECT TRANSMITTER TUBES IN CASE OF FLASHOVERS OR SHORT-CIRCUITS

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Application filed July 8, 1941

This invention is concerned with an arrangement adapted to cause disconnection of the plate potential of transmitter valves upon the occurrence of flashovers or short-circuits.

It happens occasionally that flashovers are produced in high-vacuum tubes while they are in actual operation, say, as a result of gas release, and this is liable to result in arcing. Unless such an arc is speedily broken, it will destroy parts of the electrodes with the result that the tube is rendered unserviceable. It is therefore necessary to disconnect the potential as fast as feasible from such a tube immediately after the production of an arc or flash-over or internal breakdown.

Now, safety and protection devices have been disclosed in the prior art which are predicated for their operation upon a relay which is traversed and energized by the plate current, the relay responding to the sudden rise of the current as a result of a flashover in a tube thereby causing disconnection of the plate potential rectifier. In the direct current circuit of the plate supply is included, moreover, a resistance in circuit organizations of this kind which is designed to limit the short-circuit current. From the instant the flashover of the tube happens until the oil-break switch is opened, there is an appreciable lapse of time inherent in the time mechanical switches take for response; and throughout this entire period the entire short-circuit current flows through the flashover or arc and this is likely to eventuate in destruction of the tube.

To avoid this difficulty, it is possible to use grid-controlled rectifiers upon the grid of which a blocking potential is impressed in case of a short-circuit. To be sure, in this arrangement, the cut-off of the rectifier is produced inside a few thousandths of a second; however, the flow of current through the flashover or arc ceases only when the phase of the rectifier which happens to burn passes through zero. Quite apart from this shortcoming, however, this mode of insuring disconnection inheres the further drawback that the energy stored up in the filter is also drained by way of the arc. Where transmitters of extremely large power are concerned, this alone may cause damage to the tube or render it completely unserviceable.

There is known in the prior art another arrangement designed to cause disconnection of the plate potential of large-power transmitters upon the production of flashover or arcing in which between filter and transmitter tube is arranged an inertialess or non-sluggish disconnecting device operating with thyratrons for high potential direct current. Tripping of the disconnecting arrangement occurs by way of a transformer included in the plate circuit; the said transformer upon the sudden production of a rise of current ignites an auxiliary discharge device from which a counter-acting potential is impressed upon a grid-controlled rectifier included in the plate circuit to compensate the "burning" potential thereof, with the result that the discharge ceases.

Now, all of these disconnecting or circuit opening means responding to increase of current upon flashover do not operate satisfactorily whenever the plate circuit of the transmitter valve contains an inductance, say, the output winding of a modulation transformer. If the plate circuit includes such a modulation transformer, then this high-speed relay or the impulse transformer must be so proportioned that no disconnection will be occasioned when the plate current atains twice the normal direct current value, for it will be noted that upon the direct current $Ia=$ is superimposed by the modulation a tonal frequency a. c. Ia the crest value of which, in the presence of 100 percent modulation, is equal to the direct current. If, then, the transmitter tube experiences a flashover, so that the drop of potential across it becomes suddenly very small, the sudden rise of the current will nevertheless be very small inasmuch as the internal resistance of the modulator tube transferred to the output end of the modulation transformer is rather high. Then, the plate current through the inductance of the output end of the modulation transformer begins to rise at a delayed rate and the relay or the disconnecting device will respond only after the current has gone sufficiently far beyond the level $2Ia=$. However, in the meanwhile, the flashover in the tube may have already resulted in damage to the tube. This shortcoming of the scheme will become so much more apparent where more rather than only one tube are used. For in that case, the particular tube that has suffered flashover or arcing will immediately take the plate current of all of the other tubes, and it is only when the aggregate current has surpassed the value $2Ia=$ that the relay and thus the disconnecting switch are able to respond.

Now, in an arrangement designed to cause disconnection of the plate potential for transmitter tubes, in case of flashovers or short-circuits according to the present invention, two potentials are impressed upon a relay, one thereof being proportional to the plate direct current voltage

acting at the tube, while the other one is proportional to the plate direct current of the tube, these potentials being chosen of such a value that under normal operating conditions, there will arise no pd at the relay. According to a further object of the invention, means are provided designed to prevent a discharge of the energy contained in the filter means through and across the tube flashover point or arc.

The invention will now be described in more detail by reference to the two exemplified embodiments illustrated in the appended drawing.

Fig. 1 shows the basis circuit diagram of a plate B type modulated transmitter. Referring to this figure, **1** denotes the grid-controlled multi-phase rectifier which produces the plate potential $Ua=$ of the transmitter power stage and usually also of the AF power stage. In the rectifier circuit are including the filter choke-coil **2** and the smoothing capacity **3**. The two power tubes **5** and **6** of the push-pull class B amplifier work upon the modulation transformer **4**, the output winding of which is connected in series with the transmitter tube, the output potential $Ua\sim$ thereof being superposed upon the plate direct current voltage $Ua=$ so that the transmitter stage comprising elements **7**, **8**, **9**, is subjected to plate potential modulation. Instead of a tube **7**, it would also be feasible to parallel a plurality of tubes. **8** denotes the plate oscillatory circuit, while **9** stands for the plate blocking condenser of the power stage which is chosen only of such a size that the resistance thereof for radio frequency turns out to be sufficiently low.

To produce the two poetntials required for the operation of the relay, a voltage divider **10** is connected in parallel relation to the plate blocking condenser **9**. The potential taken off at points or terminals a and b of this voltage divider is proportional to the superposed audio frequency potential $Ua\sim$. Furthermore, a resistance **11** is cut in the cathode lead of the transmitter tube or tubes. The drop of potential which arises across the said resistance is proportional to the plate direct current $Ia=$ and the plate current $Ia\sim$. The size of the said drop of potential, according to the invention, is chosen so high that the potential across terminals a and b is equal to the drop of potential across resistance **11**. Then, no potential difference will arise across terminals **12** and **13** which are connected with points b and c. Between these points is connected according to the invention a high-speed relay. Now, as soon as a flashover occurs in the tube **7**, the voltage of the transmitter stage, that is, across **9** and **10**, collapses immediately and thus also the voltage across points a and b so that instantaneously a voltage arises across points **12**, **13** which is equal to the drop of potential across resistance **11**. The high speed relay connected between **12** and **13** is able to respond immediately and the rectifiers producing the plate direct current voltage as a consequence are cut off. The arrangement here disclosed offers the advantage, as can be seen from what precedes, that in case off a tube flashover the high-speed relay will be caused to become operative and respond even when the supplied current has not yet suffered any alteration.

In actual operation and service, there is no need to make the high-speed relay too sensitive. On the contrary, means to adjust the sensitiveness may be expedient and to set the relay so that, in the case of small load fluctuations associated with alterations of the plate current such as may be occasioned, say, by variations of the tuning or the coupling in any of the circuits of the transmitter equipment, there will be no response. In some instances, for instance, in transmitters modulated in one of the earlier stages, it will be preferable to use a polarized relay which will be caused to respond only upon the electrical quantities being changed in a definite sense.

Where transmitters involving very high powers are dealt with, the protection afforded by the relay responding upon a flash over of a tube will not be adequate if it merely blocks the grids of the multi-phase rectifier in Fig. 1. The capacity **3**, as will be seen, is so high where transmitters of extra large power are concerned that even by immediate cut-off of rectifier **1**, the energy of condenser **3** becoming discharged through tube **7** will suffice to occasion destructive actions in the tube. Hence, according to a further object of this invention, additional means are provided designed to preclude discharge of the condenser through a flashover or arc in case this has been produced in a tube. In the case of large-power transmitters, therefore, according to the invention, the relay connected between **12** and **13** fulfills this further purpose to initiate instantaneous discharge of the condenser through a resistance upon the occurrence of a tube flashover. Such an example is schematically illustrated in Fig. 2.

In the exemplified embodiment shown in Fig. 2, a horn-type discharge-gap **15** is connected with the two terminals of the condenser **3** by way of a discharge resistance **14**, and in the neighborhood of the said horn spark-gap is a needle-point electrode **16** which is united with a high-potential coil (Tesla coil) **17**. Now, as soon as a flashover happens in the transmitter tube **7**, the relay connected between **12** and **13** cuts in circuit a radio frequency generator **18** which is designed to set up in the high voltage coil **17** such a high potential that the needle electrode **16** begins to exhibit corona, that the condenser **3** has a chance to discharge through resistance **14** and the sparks between the electrodes **15**.

Instead of causing the relay between points **12** and **13** to start operation of the radio frequency generator for the flashing of the spark-gap, it would also be possible to use directly the potential between **12** and **13** arising upon a flashover for the purpose to initiate oscillating in the auxiliary transmitter **18**. In the absence of a pd between **12** and **13**, under normal operating conditions such a high negative biasing voltage will then prevail at the grid of the radio frequency generator **18**, which is furnished from the source of voltage supply **19**, that the said auxiliary transmitter **18** will have no chance to start oscillating. Upon the occurrence of a disturbance or trouble in the transmitter tube, a voltage arises between **12** and **13** which is in opposition to the biasing potential so that the negative biasing voltage or transmitter **18** diminishes to a point where it is able to start oscillating, with the consequence that by way of **17** discharging of condenser **3** is initiated. So far as the said auxiliary transmitter **18** is concerned, a very small power will suffice since it serves solely to flash the spark-gap. The frequency of the same is chosen so high that oscillating is started as fast as feasible.

The circuit organization for the exemplified embodiment Fig. 2 shows also that the cathode of the auxiliary transmitter **18** is not at ground

potential. Hence, the tube is preferably heated by way of a transformer, while the plate potential is preferably produced by means of a dry (oxide) type rectifier. If several tubes are used in the wave generator, then the plates thereof may be fed with a multi-phase potential rather than direct current potential. All that is necessary is to choose the potential in such a way that there will always prevail a positive potential at least at one tube so that the auxiliary transmitter is able to start oscillating at any time.

In lieu of the spark-gap **15**, Fig. 2, could be used also a controlled thyratron or the like, HG rectifier, which, in case of flashover in the transmitter valve, is ignited. Because of the potential difference between points **12** and **13** and the controlled thyratron it is necessary to insure insulation between the igniter circuit and points **12** and **13**. For instance, the output potential of the auxiliary transmitter **18**, after rectification, may be employed for starting or striking the rectifier.

Where transmitters designed for a relatively wide band are concerned, that is, transmitters working with low carrier frequency, or transmitters having a very low-damped antenna circuit or output circuit, the transmitter stage **7**, **8**, Fig. 1, for high modulation frequencies no longer behaves like a purely ohmic, but rather like a complex resistance. In that case, for high modulation frequencies, a phase displacement angle prevails between the alternating potential $Ua\sim$ at the voltage divider **10** and the alternating current $Ia\sim$ which flows through the resistance **11**, with the result that an alternating potential arises across points **12** and **13**. In other words, where transmitters of this kind are concerned, conditions must be made so as to prevent relays or protective or safety means connected across points **12** and **13** from responding. In some cases, it may suffice to set the relay to a point where it is less sensitive, in other words, in such a way that it will respond only when a certain threshold value is exceeded. The situation becomes most simple where it is permissible to narrow the band-width to a sufficient degree. If steps in that direction are not possible, or not adequate, then a low-pass filter may be cut in between the terminals **12** and **13** and the relay or other safety device designed to suppress the higher modulation frequencies for which the transmitter is no longer ohmic in nature.

Where extra large plate modulated transmitter equipment is involved, it may occasionally become necessary to destroy and suppress also the energy of the modulation transformer **4** by means of the same kind as those provided for the condenser **3**. If desired, the discharge device **14**, **15**, **16**, could be used jointly for **3** and **4**.

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ARRANGEMENT TO DISCONNECT TRANSMITTER TUBES IN CASE OF FLASHOVERS OR SHORT-CIRCUITS

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Fig. 1

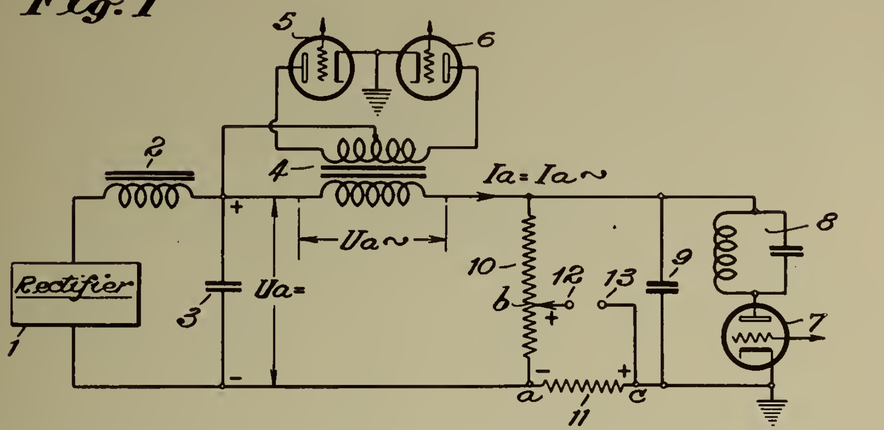
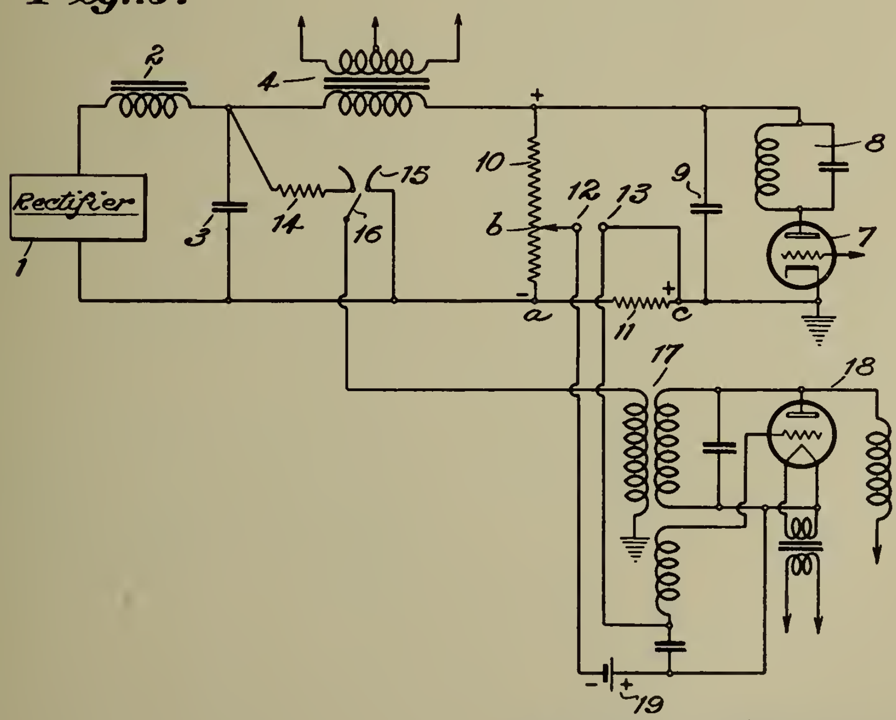


Fig. 2.



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ALIEN PROPERTY CUSTODIAN

ELECTRONIC LENS

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Application filed July 10, 1941

This invention relates to an electronic lens cooperating with a diaphragm and serving as an objective for an electronic microscope.

The object of the invention consists in designing this arrangement in such a manner that the field of view is greater than the objective diaphragm, even if the latter is so small as to permit a fading out of the electron rays to the electron-optically favorable value. This value may then be obtained if the aperture of the objective diaphragm is equal to the aperture of the condensing lens increased by the aperture of difraction of the structures to be dissolved. The objective diaphragm is arranged according to the invention in the focus of the lens at the side of the image. With this arrangement the diaphragm arranged between the object and the field avoids with certainty a restriction of the field of view of the object. If the objective diaphragm is arranged in the focus of the lens at the side of the image, the further advantage is obtained in that the diaphragm may be designed with the greatest possible diameter for the attainment of a given small aperture of the objective diaphragm. This is advantageous, since for practical reasons too small diaphragm diameters are reluctantly employed.

To adjust various focal lengths with the aid of an electronic lens, the objective diaphragm is so arranged according to the invention as to be displaced longitudinally of the optical axis. In this case, the devices for displacing the diaphragm are preferably so designed that the displacement is effected under vacuum during the operation of the electronic microscope.

In the accompanying drawings is shown an embodiment of the invention in diagrammatic form.

Fig. 1 is a sectional view of an electromagnetic objective lens of an electronic microscope. 1 denotes the winding of the lens which is surrounded by a jacket 2. At the ends of the jacket 2 are arranged the pole shoes 3 and 4 of the lens. A diaphragm 5 secured to a tubular carrier 6 is allotted to the objective. To enable the displacement of the diaphragm in the direction of the ray, the tubular holder is designed at the side of the lens in the form of a rack 7 cooperating with a pinion 8. The pinion may be rotated in a known manner exteriorly of the apparatus by means of a conical plug having a ground surface to maintain the vacuum at a constant value. In this manner, the diaphragm 5 may be displaced until it lies in the focus of the lens at the side of the image.

Fig. 2 shows the path of rays of an objective lens according to the invention. 9 denotes the object to be magnified and 10 is the electron ray coming from the cathode. The diaphragm 5 is arranged as will be seen from Fig. 2 in the focus of the lens at the side of the image. 11 denotes the image of the object magnified by the lens. The object 9 and the diaphragm 5 may each be displaced both in the upward and downward direction.

Similar advantages may be obtained also when employing electrostatic lenses.

ERNST RUSKA.

PUBLISHED

MAY 25, 1943.

BY A. P. C.

E. RUSKA

ELECTRONIC LENS

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Serial No. 401,781

Fig:1

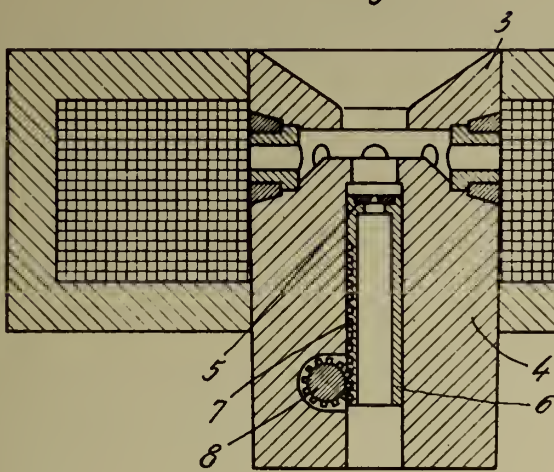
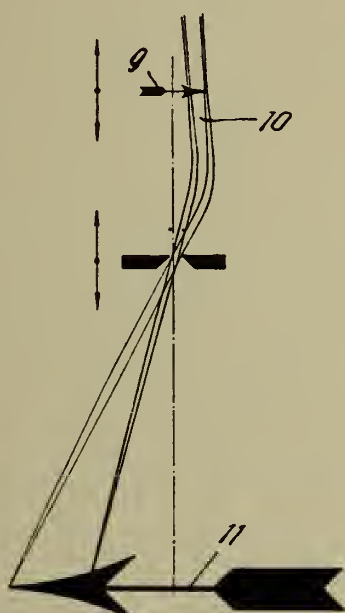


Fig:2



Inventor:
Ernst Ruska
By Richardson & Geier
Atty's

Published May 25, 1943

Serial No. 401,813

ALIEN PROPERTY CUSTODIAN

ELECTRONIC MICROSCOPES

Manfred von Ardenne, Berlin-Lichterfelde-Ost, Germany; vested in the Alien Property Custodian

Application filed July 10, 1941

This invention relates to improvements in electronic microscopes, and more particularly to an object sluicing device for electronic microscopes.

The devices hitherto known for inserting and removing the objects in and from the vacuum chamber of electronic microscopes require greased sealing surfaces. To ensure a proper sealing, the ground surfaces must be greased from time to time.

The object of the present invention is to provide a sluicing device for objects to be introduced into the vacuum chamber of electronic microscopes, in which the greased sealing surfaces are dispensed with so that it is no longer necessary to control the apparatus as to whether the vacuum chamber is vacuum proof. According to the invention the portion of the inner space of the microscope intended for the reception of the object may be disconnected from the other parts of the microscope by two sluice valves provided with rubber packings. The sluice chamber for the reception of the object cartridge is sealed by rubber packings so that greased ground surfaces may be entirely eliminated. The valve drive is preferably effected with the aid of a valve rod to be actuated exteriorly of the apparatus, the valve rod being in turn sealed by a resilient body. In order to keep the space in which a high vacuum is to prevail as small as possible, a second rubber packing, by means of which the space closed by the resilient body is separated from the vacuum chamber after the object has been sluiced into the vacuum chamber may be arranged according to the invention at the side away from the path of rays.

In the accompanying drawings is shown an embodiment of the invention in diagrammatic form. Fig. 1 shows a sectional view of a part of an electronic microscope; Fig. 2 is a view of the part of the microscope shown in Fig. 1, partly in section, in which is shown a sectional view of the object sluicing device. Fig. 3 is a top view of the part ol the microscope.

Referring to the drawings, **1** denotes the coil of the objective lens. Around the coil body is arranged a cooling water jacket **2**. The objective is designed in the form of a pole shoe lens. One pole shoe is formed of the outer jacket **3**, the upper cover **4** and the pole shoe end **5**, whereas the other pole shoe is formed of the inner jacket **6** and the pole shoe end **7**. The pole shoe ends **5** and **7** are combined in an interchangeable insert body. **9** denotes the object cartridge. The intermediate piece **10** between the parts **4** and **6** is made of non-magnetic material. **11** is the inner space of the electronic microscope in which the object is inserted. The inner space **11** may be disconnected from the other parts of the microscopic inner space with the aid of two valves **12**, **13**. The valves are provided with circular grooves **14** in which is arranged a rubber ring **15** serving to seal the inner space **11** against the upper and lower parts **26** and **25** of the vacuum chamber. With the valve closed as shown these rubber rings **15** seal the inner space **11**. **16** denotes the valve rod serving for the drive of the valve body **12** and cooperating with the bushing **17**. A resilient body **18** serves to seal the valve rod. The valve is opened and closed by operating the outer drive **19** (Fig. 3). The valve body **14** is provided at the side away from the path of the electron rays with a second rubber ring **20** which is in engagement when the valve is open with the sealing surface **21**, thus sealing the space **22** enclosed by the resilient body **18** against the exhausted inner chamber of the electronic microscope. In this manner the space in which a high vacuum is to prevail may be kept particularly small. The bushing **17** is firmly held in position with the aid of the threaded sleeve **23**. **24** denotes a channel surrounding the space **11** and by means of which the space **25** and the space **26** of the electronic microscope lying respectively below and above the space **11** may be properly exhausted.

In Fig. 2 is shown the removable pole shoe insert body **8**. This body is firmly held against the holding ring **28** by means of the pressure bushing **27**. **29** denotes the cartridge holder which may be slightly brought out of alignment against the action of the spring **31** with the aid of an adjusting screw **30** so that an adjustment of different sections of the object is possible without influencing the adjustment of the optical system. The cartridge holder **29** may be firmly held in position in the pole shoe insert body **8** with the aid of the threaded sleeve **32** and of the rod **33** cooperating therewith.

Also in the case of removable pole shoe inserts rubber rings **34**, **35** and **36** must be employed at convenient points for sealing the vacuum chamber against the outside atmosphere.

MANFRED von ARDENNE.

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MAY 25, 1943.	ELECTRONIC MICROSCOPES	401,813
BY A. P. C.	Filed July 10, 1941	2 Sheets-Sheet 1

Fig. 1

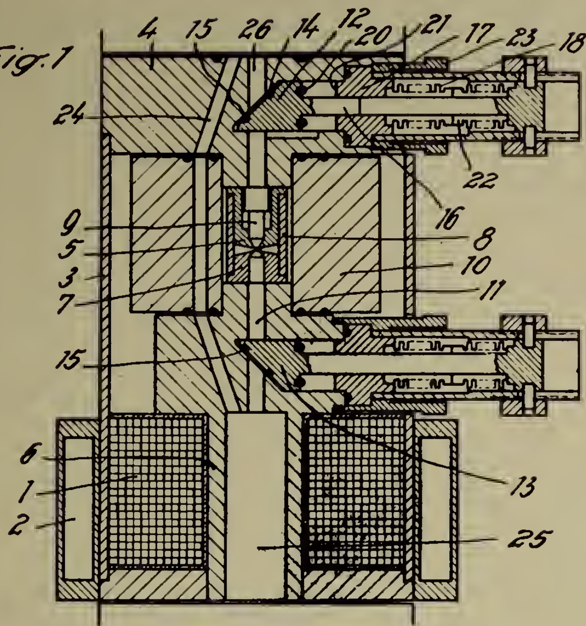
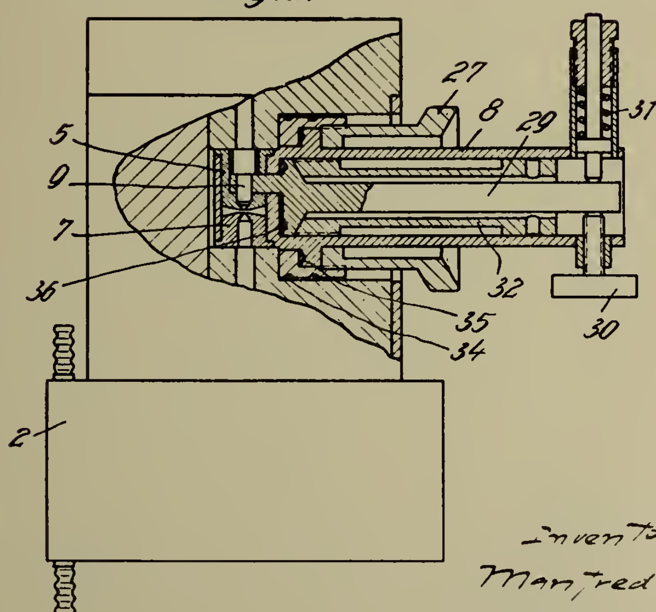


Fig. 2



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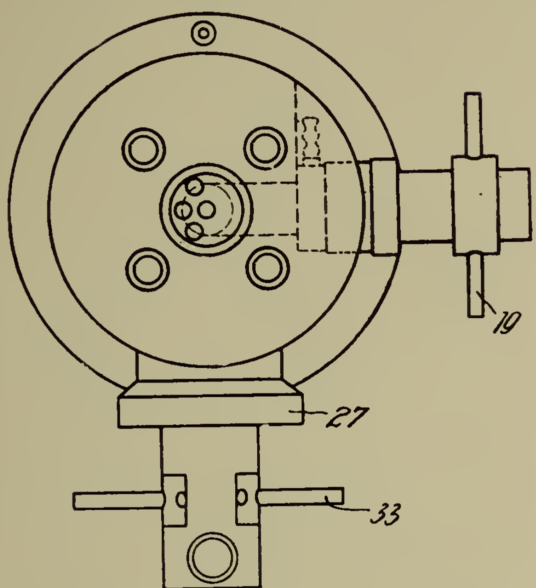
2 Sheets-Sheet 2

Fig. 3



Inventor:
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ALIEN PROPERTY CUSTODIAN

OBLIQUE JUNCTION-PLANE RAIL JOINT

Manlio Cipolla, Pavia, Italy; vested in the Alien Property Custodian

Application filed July 11, 1941

This invention relates to rail joints for railroad tracks, and particularly to a type of such joints wherein the wheel-load is supported by the rail heads throughout the length of the joint and all dynamic loads on the joint are thus eliminated.

In the conventional types of joints the two adjacent rails are laid end to end with a small clearance left therebetween to allow of thermal expansions and contractions of the metal, and are then fished or otherwise suitably connected. These types of joints therefore comprise a short gap from the end plane of one rail to that of the other wherein the wheel-load is not supported by the head of either rail. When a wheel leaves the first rail, it falls for a brief instant into said gap and thus acquires a certain momentum in a direction perpendicular to the face of the rail which is the cause of a shock when the wheel comes into contact with the second rail. Such shocks repeated at frequent intervals are harmful to the rolling stock and they also cause wear in the rail joint and deformation of the same in ever increasing proportions. It is understood that these phenomena are well known and their consequences and import fully apprehended by persons skilled in the art.

The primary object of this invention is to provide a novel and improved type of rail joint wherein the two rails to be jointed are associated in a manner to provide a continuous supporting surface for the wheel-loads throughout the entire length of the joint and the load is gradually transferred from one rail to the other, so that all shocks in the passage of the wheels over the joint are eliminated and the mechanical and wear conditions of the rolling stock, of the rails, and of the joint are considerably improved.

Another object of this invention is to provide a rail joint wherein the ends of the adjacent rails are secured together by suitable locking means and are so strengthened as to accommodate said locking means without becoming dangerously lightened or weakened.

A further object of this invention is to provide a rail joint of the type described, wherein the ends of the two rails to be jointed are provided with suitably matching vertical and horizontal plane surfaces to assure great compactness, strength, and resistance to wear, and wherein said matching surfaces constantly engage each other irrespective of any thermal variations in the length of the rails.

A still further object of this invention is to provide a rail joint of the type described wherein the locking means used for securing the rails to each other comprise resilient elements, and allow of longitudinal adjustments of the joint due to thermal expansions or contractions of the rails, while a sufficient locking pressure is maintained by said resilient elements on the rails notwithstanding said longitudinal adjustments.

A still further object of this invention is to provide a rail with complementary shaped and reinforced ends adapted to cooperate with other similar rails to form joints of the type described. Other related and ancillary objects will clearly appear as the description proceeds.

A preferred embodiment of the invention is shown by way of example in the appended drawings wherein:

Fig. 1 is a side elevation of a joint according to the invention, showing the cross-ties and seat-plate in section.

Fig. 2 is a plan view and partial horizontal section of the rail joint of Fig. 1.

Fig. 3 is a vertical section of Fig. 1 on the line A—B of Fig. 1.

Referring to the drawings, the numerals 1 and 2 denote the two rails to be jointed. Rail 1 is cut along a vertical plane forming an acute angle with the plane of symmetry or axial plane of the rail, rail 2 is cut along a parallel plane, and the two oblique surfaces engage each other over their entire area, as shown at 8, Fig. 2.

The web of rail 1 has a thickened portion 9 on the side thereof opposite to the junction plane 8. In the embodiment the web has been thickened as much as it is necessary to bring it flush with the outer edge of the head 10 of rail 1. The web of rail 2 has a thickened portion 11 on the side thereof opposite to the junction plane 8, of the same thickness as the portion 9. Both webs are also slightly thickened at the beginning of the junction plane 8.

The flange of rail 1 is raised to provide a step at 12; thus the bottom portion of the rail 1 throughout the length of the joint has a flat sole 13 located on a plane higher than the plane 14 of the foot of the rail proper. The flange of the rail 2 on the other hand is provided with a flat horizontal end portion 15 on which the sole 13 bears.

The ends of both rails are seated on a seat-plate 4 fastened to the cross-ties 7 by means of spikes 6. To further secure the rails there are provided four clips 16 held by bolts 5 equipped with resilient washers. The two rails are held together by locking bolts 3 shown in number of three, provided with resilient washers 17. To

accommodate said bolts, rail 1 has circular bores 18 and rail 2 has horizontally elongated bores 19 to allow of longitudinal adjustments of the joint.

When the temperature changes and the rails undergo expansions or contractions, they slide relative to each other along the junction plane 8. This causes a slight decrease in the thickness of the joint, which is compensated by the elasticity of the resilient washers 17 which maintain the transversal locking pressure on the rails substantially constant or at any rate sufficient in spite of all such variations.

It will be noted that, when a wheel-load passes over a joint of this nature, the load is gradually abandoned by one rail and gradually received by the other, thanks to the fact, that throughout the joint both rails cooperate in supporting the load. In ordinary joints, even disregarding the shock due to the gap between the rails, the transmission of the load from one rail to the other is practically instantaneous, whereby the rails themselves and all the elements of the track are submitted to an additional strain. This strain is completely eliminated by the invention.

MANLIO CIPOLLA.

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BY A. P. C.

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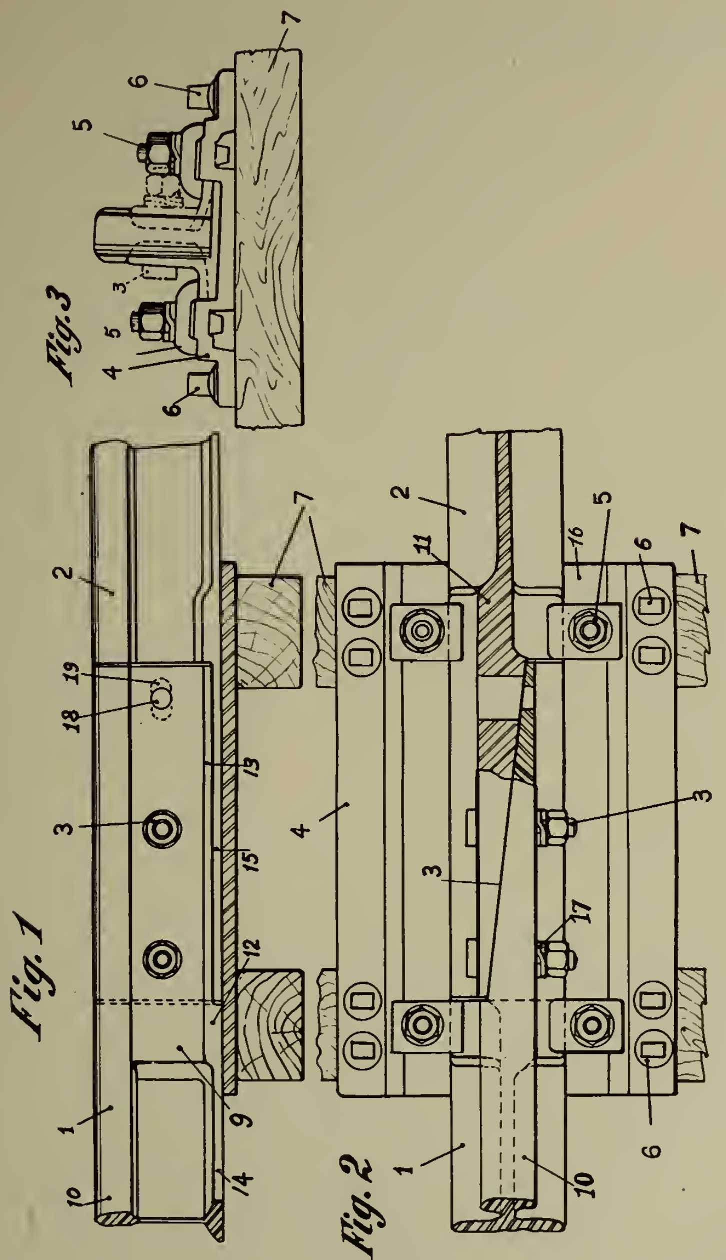

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ALIEN PROPERTY CUSTODIAN

CONTINUOUS METALLURGICAL TREATMENT OF RAW MATERIALS

Julius Lohse, Berlin-Wilmersdorf, Germany; vested in the Alien Property Custodian

Application filed July 12, 1941

My present application constitutes a division of my co-pending application Serial No. 361,314 filed October 15th, 1940, which is a continuation-in-part of my former application Serial No. 227,488 filed August 30th, 1938. The invention of my present application relates to a continuous metallurgical treatment of raw materials in a flame chamber, more particularly for the desulphurization, chlorination, roasting or drying of ores, concentrates or other minerals, and has for its object to provide improvements by which there is rendered possible a uniform dressing of the material in one operation, for example, in the case of roasting treatment even up to the extent of dead roasting, at the same time all manual operations together with any parts conducted through the material during the roasting operation and consequently subjected to considerable wear being avoided. Other advantages reside in the completely automatically regulable nature of the dressing treatment, which owing to a special returning means provided in accordance with the invention necessitates merely a short body or flame chamber and thus assists considerably to reduce the cost of the plant.

For the desulphurization and roasting of ores, concentrates or other products containing sulphur it has already been proposed, apart from the roasting processes previously usual in open kilns and stalls, to perform this roasting by hand in reverberatory furnaces of the material-advancing type with direct or indirect heating. It is also known to perform the manual operation by means of rakes suspended on chains, and on the other hand to make the arrangement of the furnace such that roasting is performed on the different levels of a circular shaft furnace.

In this connection it is also old in the art to disintegrate the ore or other product to be roasted, so that the rakes do not require to work through large lumps of ore but merely through a material ranging in size between a coarse granular and a powdery condition. In this way furrows are formed in the material in the direction of movement of the rakes, which present an increased surface area to the action of the roasting gases, as a result of which, by reason of the movement of the rakes, material not yet roasted is brought into action successively.

This disadvantage of apparatus operating with rakes consists on the one hand in the fact that the rakes are unable to convey the material down to the last grain, within range of the roasting action, so that a complete roasting of the material is only possible by continuous repetition of the roasting process and even then it is not of a regular kind. On the other hand the disintegrated material under the movement of the rakes, transfers its fine particles of dust to the current of heating gas and over-saturates this current, so that the roasting effect is obstructed.

It is also known, for the purpose of avoiding a dragging movement on the part of the rakes together with the disadvantages associated therewith, to supply the preliminarily disintegrated material to a revolving furnace, which passes the material in slow progressive movement through the flame chamber. To heat a revolving furnace of this kind it has been proposed to provide numerous air, gas and oil nozzles distributed along the length of the furnace, by means of which nozzles the roasting flames can be ignited at different points of the furnace and thus act on the material always with a new roasting effect.

Since the revolving furnace nozzles of this kind are of necessity covered successively by the material to be roasted and the burning of a roasting flame when covered by the material in direct fashion is not possible, extensive control means and control pipes are necessary along the complete furnace, which cause the flame to be ignited only at the moment when the nozzle in question is located above the charge. Despite the even movement of the material within the furnace there is nevertheless created in the furnace, as a result of slipping action and the whirling effect of the tuyeres and the gas nozzles a dust, which likewise chokes the atmosphere of the furnace, so that the roasting operation is considerably obstructed, whilst moreover in utilizing the waste gases extensive dust-filtering means must be provided, from which the incompletely roasted ore dust must be returned to the furnace for additional treatment.

Whilst the furnaces furnished with rakes exhibit a very appreciable wear of the rake arms and the rakes themselves, and the replacement of these cast iron parts is not only health-impairing and costly but also requires a certain amount of time, the revolving surfaces of the kind referred to, owing to the flames conducted radially in the interior thereof, also exhibit considerable wear of the brickwork and corrosion of the nozzles, which at times are covered by material and at times are exposed in the flame chamber. Repairing of the brickwork is a very complicated matter, even in the case of a single furnace, as the brickwork consists not merely of simple radial bricks but expensive shaped bricks of many different forms.

My present invention is based on the idea of employing as a carrier for the entire roasting operation the flame in conjunction with the ore dust which hitherto was considered during desulphurization and roasting as a great evil, but which according to my invention is introduced in such a way into the flame and preferably into the whirling flame that the large surfaces of the dust particles are continuously acted upon by the roasting agent. The problem with which the invention is primarily concerned consists in maintaining the dust and other ore particles during the roasting operation in intimate contact with the roasting agent and the solution to the problem resides in injecting the mixture for roasting into a hot chamber, preferably by charging them on to a whirling flame, whilst maintaining the current of roasting gas under pressure and performing the complete roasting operation in this hot current.

According to my invention, the ore, in a finely divided condition, is injected in common with the roasting agent under pressure into a hot chamber, floating in the current of roasting gas, and is again sucked off from this chamber whilst the current is maintained.

The fundamental idea of my invention resides not only in carrying out the roasting operation within an oxydizing flame zone, but also, owing to the large surface of the particles of dust and the favorable liberation of the affinitive forces of the roasting gases in relation to the material to be roasted, in making the roasting more spontaneous than has ever been possible heretofore in a flame chamber.

Additional to the above my invention also makes provision for the fact that, if necessary, the gases sucked off from the furnace and bearing the particles of ore floating therein are again mixed with fresh air and introduced into the furnace anew. The return of the sucked up gases takes place in opposition to and in such a manner and under such pressure as to distend the primary flame to a hollow cone.

Owing to the distension of the roasting flame in a flame chamber and by reason of fresh air added, the hot particles of ore give off within the flame in addition to their own heat, that of the sulphur or other additions included therein and thus exert an extremely favorably influence on the thermal economy of the complete treatment.

Owing to my invention of performing roasting in the hot current of a roasting flame and also by reason of the possibility of repeating the roasting operation one or more times in this current, it is possible to roast down the sulphur to small percentages, even to the extent of dead roasting, which result has not been attained with the apparatus previously in use.

According to my invention it is also proposed, after completion of the roasting operation, to conduct the current of gas with the particles of dust to a filtering device, whilst the large pieces precipitated in the furnace as a result of agglomerating are conducted by the rotary movement of the furnace into a collection hopper.

In addition to the stated advantages consisting in an increased roasting effect and the possibility of performing roasting even up to the extent of dead roasting the revolving furnace according to my invention is subject to much less wear than the apparatus previously in use, as a flame impinges on the brickwork of the furnace not radially, but at a tangent and also in whirling form, and a variation in temperature caused by the rotary movement with respect to those parts of the furnace, situated at one time above the charge in the flame chamber and at another time in cooling fashion beneath the charge, does not take place. There is also the advantage that the furnace can be bricked with simple radial bricks, the production of which is simpler and cheaper than that of shaped bricks. The total cost of a plant of the nature is accordingly very much less.

An additional advantage can be obtained according to my invention by providing the furnace with a regulable burner, which can be adjusted completely automatically by the use of known regulating means. By the use of a completely automatic device of this nature the roasting operation can be carried out independently to the skill of the man in charge, so that a certain roasting process having a certain roasting action can be adjusted once and for all solely on the basis of tests carried out in the laboratory.

My invention is illustrated by way of example in the accompanying drawings, in which

Fig. 1 shows diagrammatically in elevation and in partial section a plant in which roasting is performed in an open flame current.

Fig. 2 is a sectional view on the line II—II in Fig. 1.

Fig. 3 is a partly sectional view on a larger scale of the burner shown in Fig. 1 diagrammatically.

Fig. 4 is a section on the line IV—IV in Fig. 3 showing more clearly the distribution of the intake pipes of the burner.

Fig. 5 is a sectional view along the line V—V in Fig. 1.

In Fig. 1 the material is introduced together with the requisite coal into the hopper 1 in a disintegrated condition approximately equivalent to a screen mesh of 20—40. The ground material is blown through the pipe 2 to a worm in the burner 3. In the burner nozzle 4 there is an intimate mixing of the materials employed, for example oil, gas, coal and sulphide ores with secondary and primary air, with simultaneous agitation, so that after ignition of the flame the latter whirls in the form of a long conical flame 8*a* in the bricked conical jacket 8 of the furnace.

The burner structure comprises an air chamber 23 which encloses the nozzle structure 4, and opens at its forward end into the furnace 8, around the nozzle 4 at 24. Extending through the rear end of the a chamber and into the rear of the nozzle 4 is a screw conveyor tube 25, in which is a screw conveyor 26, supported upon a tubular shaft 27. Into the screw conveyor there open the three inlets 3*a*, 3*b* and 3*c*, the inlet 3*b* receiving the pulverized ores, while gas and coal dust are fed into the conveyor tube 25 by way of the inlets 3*a* and 3*c* respectively.

Fuel oil under pressure is fed through the pipe 28 to a suitable feed ring 29 surrounding the rear end of the tubular screw conveyor shaft 27 from which ring the fuel passes into the tubular shaft by way of apertures not especially marked. This fuel is discharged at the forward end of the shaft in the burner nozzle 4 where it mixes with the gas, powdered coal and minerals to be blown into the furnace.

The rear end of the screw shaft is connected with a rotor 21 which is driven by compressed air supplied through the pipe line 22 through a suitable nozzle against blades forming a part of the rotor 21, and by this means the screw is turned to feed the several materials to the burner. The

air employed for driving the rotor 21 passes out of the rotor casing into the pipe line 33 and is discharged in the air chamber 23, as shown.

Disposed within the forward end of the burner nozzle 4 is a needle 34 which is adjustable in the opening of the burner nozzle 4 to regulate the size of the same, and this needle is supported upon a stem 35 which passes through the tubular shaft 27 and through the rotor 21 where it is threadably connected in a suitable supporting nut 36 so that the opening being turned as by means of a control belt 37 which encircles the rear end of this stem 35, it may be fed forwardly or retracted in the burner nozzle if desired.

The numerals 38 and 39 designate air feed channels which lead from a compressed air chest 40 respectively to the rear end of the burner nozzle 4 and the air chamber 23. The numeral 41 designates the air inlet for the air chest. The afore mentioned air pipe 22 is branched off the channel 38. Within the air chest 40 are valves 42 and 43 which are under the control of suitable automatic regulating mechanism for governing the flow of air through the feed channels 38 and 39. Such regulating mechanism comprising, for instance, a pair of gear wheels 40*e* and a motor 40*a*, controlled from a pyrometer 40*b* arranged within the chamber wall 8, with indicator 40*c*, over an impulse producer 40*d*, and may incidentally be used for also regulating in accordance with the air admission into the nozzle 4, the air admission to the rotor 21, by means of an extended shaft 40*b* and a gearing 40*h*, and the position of the needle 34 by actuating the belt 37, whereby the stem 35 is advanced or retracted.

The stem 35 carrying the needle 34 is tubular and means is provided, as indicated at 44, for carrying thereinto through a pipe line 45 connected with a suitable source of supply, any gases which it may be found desirable to introduce such as oxydizing or chlorinating gases.

At the opposite end of the furnace there is a discharge section 8*b*, into which projects a refractory blast pipe 9 extending approximately to the base of the two cones of the double-conical revolving furnace 8. This blast pipe has compressed fresh air supplied to the same by the fan 14 through pipe 14*a*. Another fan is connected, by means of pipe 6, centrally to a chamber 7, into which the discharge section 8*b* of the rotating furnace 8 projects and out of which the fan 10 sucks the sulphurous acid-gas formed during the roasting action, and a part of the furnace gas laden with particles of ore, which are returned and injected through the pipe 9 into the flame corona (funnel) to be again subjected to the hottest region of the spontaneous preliminary treatment in the long whirling flame. At 7*a* lumps, cakes and coarser particles can be discharged into trucks, the material in the discharge funnel of chamber 7 always forming an airtight and gastight seal. The recycling of the ore particles withdrawn by means of fan 10 is performed by a special apparatus, comprising a pipe 11 and an oval shaped chamber 12 (Fig. 5), provided with filter curtains 14*d* which cause the coarser particles to settle above the bottom where a conveyor 14*b* moves them into a series of discharge pipes 14*c* projecting into the above mentioned blast pipe 14*a*. The air blast therein set up by the fan 14 returns the discharged coarse and fine ore particles into pipe 9 as described. The revolving movement of the conveyor screw 14*b* is derived from the shaft of the fan 10 over a belting 8*h* and speed lowering gear 8*k*. The chamber 12 precedes a filtering tower 16 which may be of any approved construction and is provided at its lower end with a centrifugal device or a fine bronze jacket screen 13 through which the fan 10 forces the current of sulphurous acid-gas and air through bag filters 15. The bronze screen retains the coarser material and accumulates it in the lower funnel portion of the tower 16 along with the dust falling from the bags, which bags can be subjected to a mechanical shaking operation to assist the separation of the dust.

The filtering gas can be sucked up at its lower end by an exhauster for treatment in a sulphuric acid plant not shown. The tower 16, in which the filter bags 15 are suspended, possesses above the bags a comparatively large empty space which during the operation is filled with the combustion gases, which are lighter than sulphur trioxide, so that nitrogen, carbon monoxide or carbon dioxide, are able to escape into the air through a pipe 17. This arrangement within the tower 16 permits of a preliminary separation of the flue gases, as carbon monoxide with a specific weight of 0.967, nitrogen with a specific weight of 0.971 and carbon dioxide with a specific weight of 1.525 will always be displaced upwards in relation to sulphur dioxide and sulphur trioxide having specific weights of 2.214 and 2.765 respectively. At the finest material such as copper, iron oxide, ferric oxide, zinc oxide, etc., is preferably sucked off with preclusion of the air and discharged for example into trucks.

It is shown in Fig. 1 that the chamber 8 rotates upon rollers 8*c* (Fig. 2). The movement is derived from a motor 8*d* over gearing 8*e*. This motor also actuates, over a shaft 8*f* and a belting 8*g*, the fan 10.

JULIUS LOHSE.

PUBLISHED

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J. LOHSE
CONTINUOUS METALLURGICAL TREATMENT
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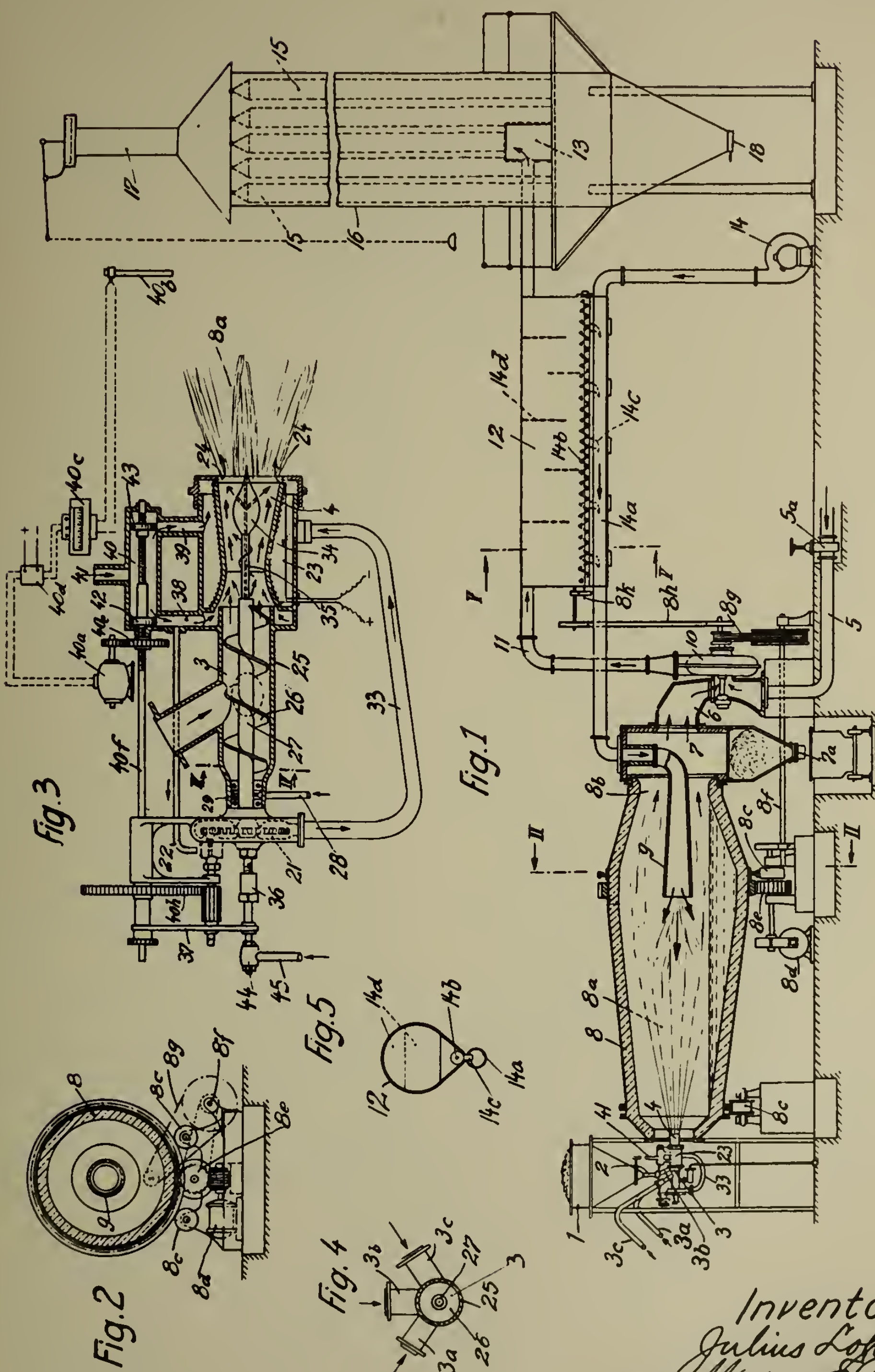

Inventor:
Julius Lohse,
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ALIEN PROPERTY CUSTODIAN

HEAT EXCHANGER

Ernst Nanz, Stuttgart S, Germany; vested in the Alien Property Custodian

Application filed July 16, 1941

This invention relates to a heat exchanger in which the heat exchanging media cross each other in countercurrent and the chambers for the flow of these media comprise thin square metallic sheets of equal size and interposed thin elastic framelike sealing members also of equal size.

The feature of the invention resides in providing the sheets with upturned edges and equipping both the sheets and sealing members near their edges with narrow slots forming registering passages which in the sheets appear on three sides thereof while the sealing frames are fitted therewith only on two opposite sides, the other two sides thereof forming narrow strips positioned outside the slots of the sheets and acting as sealing means.

The heat exchanger according to the invention is of simple construction, can be easily manufactured, is highly efficient, since the heat exchanging media intersect on a large surface, and insures good heat transfer owing to the thinness of the sheets. Furthermore, notwithstanding the elasticity of the sealing means the chambers are nevertheless quite low.

The invention is illustrated by way of example in the accompanying drawing, in which

Figures 1 and 2 are top views of two sheets in different positions of use;

Fig. 3 is a cross section of a sheet;

Figs. 4, 5 and 6 are, respectively, two top views and a cross section of a sealing member; and

Figs. 7 and 8 are two vertical sections, displaced 90°, of a number of chamber units formed of sheets and sealing members.

Each chamber of the heat exchanger according to the invention comprises flat square thin-gage metallic sheets *a* of equal size, which are elastic and made for instance of rubber. The sheets *a* possess on three sides near their edges slotlike passages *c*, and the sealing members *b* are fitted with similar passages *d* near the edges of two opposite sides, the size and position of the passages being such that the passages *d* of the members *b* register with the passages *c* of the sheets *a* when the members *b* are placed on the sheets *a*.

The passages *c* and *d* are symmetrically arranged relative to the axes $x—y$, as indicated particularly in Figs. 1, 2 and 4, 5, so as to register at the proper position of the members *b* and sheets *a*.

To insure proper positioning of the sheets *a* and sealing members *b* during assembly of the heat exchanger the edges *e* of the sheets *a* are slightly bent up in such manner that they do not interfere with the compression of the sealing members *b* when the units are fitted together.

To protect the sheets *a* from bulging out due to the pressure of the heat exchanging media and to prevent a reduction of the height of the flow spaces, which is low per se, spacing members *f* are provided on the sheets *a*, which in the example shown are placed near the passages *c*, though they might be differently arranged and distributed for instance over the entire space.

In the construction illustrated every heat exchanging medium flows through every other exchange space, as indicated in Figs. 7 and 8, but it is possible of course to let one of the media flow through several adjacent exchange spaces.

ERNST NANZ.

PUBLISHED

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E. NANZ

HEAT EXCHANGER

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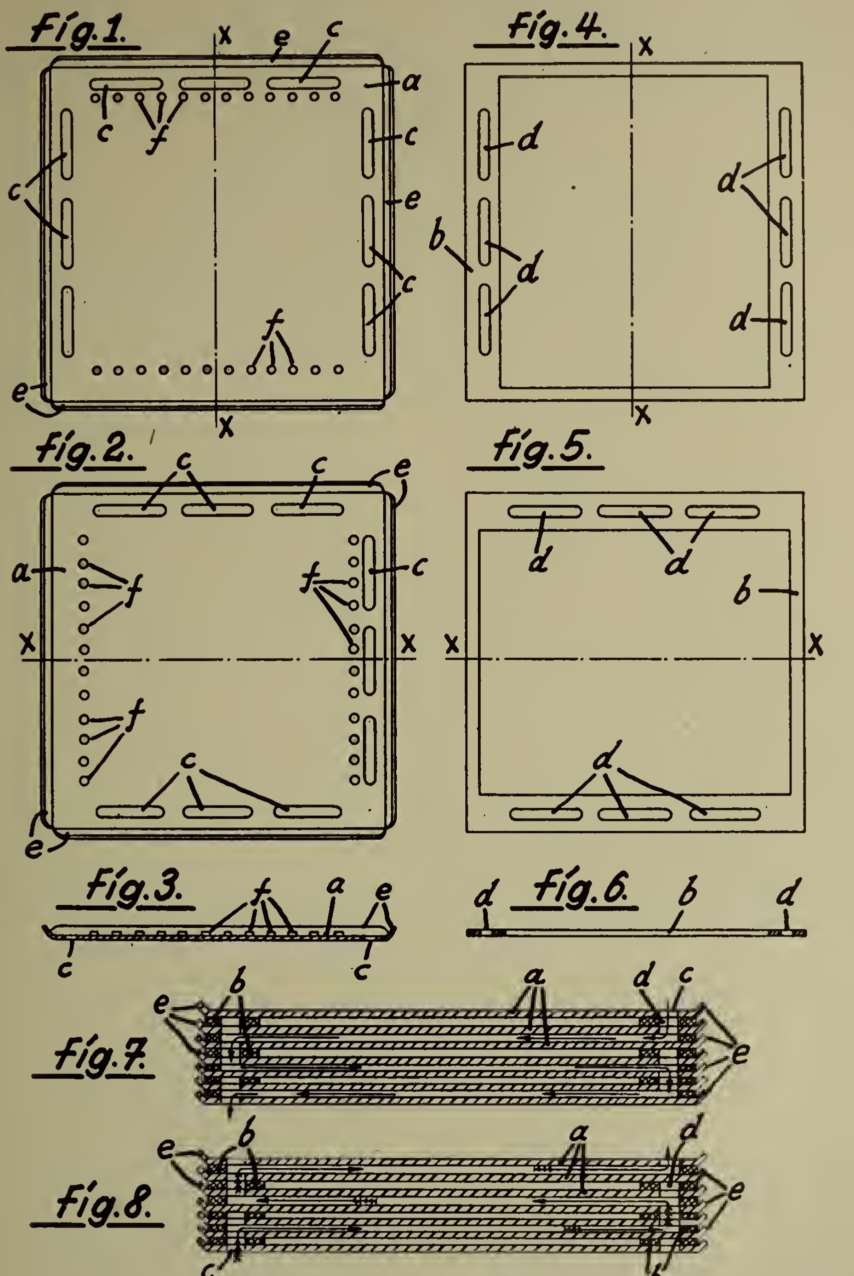

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ALIEN PROPERTY CUSTODIAN

CASH REGISTER

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This invention relates to a cash register particularly adapted for salesmen, on the operation of which an amount in proportion to the amount of sale, for instance a per cent tax, is indicated on the check to be delivered to the customer and added to the amount of sale by means of a totaliser.

The purpose of the present invention is more especially to provide the cash-registers of the character above referred to with means for indicating the accumulation of the per cent amounts (for instance to be paid as sales tax) on the effected sales. The check is given to the customer as a receipt for the tax due on the amount of sale. The sealed totaliser is periodically inspected by the finance officer thus determining the amount to be paid by the salesman to the revenue office.

The tax being a percentage of the amount of sale, an amount of sale, which is intermediate between two fixed values, is taxed on the lower of these values. Thus, for instance, if the tax is 2% and the lowest tax amount is 5 cents and increases by fives, the lowest tax amount will correspond to a sale amount between 0 and 2.50, and thus for all sale amounts from 2,55 to 5 dollars a 10 cents tax should be paid, that is to say a 10 cent tax is due on all sale amounts between 2,55 and 5 dollars. The salesman sets the cash-register on the numerals which comprise the amount of sale. If the latter is, for instance, 3.75 dollars, the salesman sets the register on the numerals "2,55–5.00 dollars", whereupon the indication is given to the customer that the tax due is 10 cents and this amount is printed on the check and accumulated in the totalizer. On setting the register on the amount of sale, the register is simultaneously prepared for printing the corresponding tax amount and accumulate it in the totalizer. The salesman introduces then with his left hand the check to be printed through a slot in the register, operates the crank handle with his right hand thus recording the tax on the check and accumulating it in the totalizer. No spring is used in this improved cash-register for operating the totalizer, thus preventing the register from becoming unserviceable or working in an inexact manner owing to wear of the springs.

Referring to the drawings:

Fig. 1 is a longitudinal section through the shaft of the setting drums, the printing device and other parts being omitted.

Fig. 2 is a partial sectional view of the printing device on line II—II of Fig. 1.

Fig. 3 is a sectional view on line III—III of a detail of the operating mechanism;

Fig. 4 shows the mechanism of Fig. 3 in a different position;

Fig. 5 is a sectional view on line V—V of Fig. 1 of another detail.

Fig. 6 is a sectional view on line III—III of Fig. 1 of the lock omitted in Figures 3 and 4.

Fig. 7 is a sectional view on line VII—VII of Fig. 1 of a modified construction of the lock.

Fig. 8 is a sectional view on line VIII—VIII of Fig. 7.

Fig. 9 shows the lock which is engaged when certain members are in an intermediate position.

Fig. 10 shows in connection with Fig. 2 the printing device.

Figures 11 and 12 show two notations of amounts of sale and tax amounts.

The cash register is arranged in one piece casing **13** comprising a base plate of rectangular section, two vertical side walls, a slightly inclined front and rear wall and an upper dome-shaped cover. A setting wheel **1** projects from the left side of the machine, a crank handle **2** is fitted on the right side. Through a glass window **3** on the right side of the front wall (Figs. 11 and 12) is observable by the customer on the left side the amount of sale set by the salesman and on the right side the tax corresponding to said amount of sale. On the rear side of the register the salesman can see through a glass window **3** the amounts set by him.

Instead of the setting wheel and glass window a pointer could be used which is set by the salesman and indicates the amounts on a plate or the like. Two transversal walls **7** and **11** in the casing but not extending throughout it carry the main shaft **9** of the register, on which are fitted the setting wheel **1** and the crank handle **2**. The main shaft **9** carries moreover a printing drum **15** for printing the tax amount and indicating drums **60***a*, **60***b*, **60***c*. Finally on the main shaft **9** are loosely mounted three drums **74**, **75**, **76** adapted to set and print the date. The drums **74**, **75**, **76** are controlled by means of pinions **77** (fig. 2) the hollow shafts of which are loosely mounted in each other. The shafts of the pinions are operated by means of a three steps key, each one of these steps operating each one of the three shafts of the pinions. This date key is introduced through a slot in the casing **13**. The main shaft **9** extends throughout the casing **13** and projects on both sides therefrom. The main shaft carries moreover the operating wheels for the totalizer. The hub of the crank handle **2** is loosely mounted on the main shaft **9**. The totalizer drive wheels are operated by the crank

handle 2 through a secondary shaft 80, on which is keyed a gear 81 meshing with an intermediate gear 101, integral with a gear 102 meshing with a pinion 2*a* integral with the hub of the crank handle 2. On the secondary shaft 80 is secured a gear 82 transmitting the rotating movement from the crank handle 2 to the totalizer. The totalizer driving means consist of a sleeve 83 fitted on the main shaft 9 and carrying at its central part a gear 84 permanently meshing with the gear 82, and gears 85 and 86 loosely mounted, and permanently coupled with the totalizer 22 the gear 85 being integral with a wheel 87 and gear 86 with a wheel 88. On the periphery of each of the wheels 87 and 88, which are similar and symmetrically arranged (figures 3 and 4) are formed forty notches and a pawl 89 coacts with each of the wheels. Each pawl is arranged on a lever 90 on the sleeve 83 and is subjected to the action of a spring 91 connected to the lever 90 and pawl 89 and tending to hold the pawl in the raised position relatively to the wheel 87 or 88. The above described mechanism serves to indicate 40 different amounts of tax for amounts of sale comprised between 0 and 100 dollars; the amounts of sale being subdivided in amounts increasing by 2,50 dollars.

For each one of the wheels 87, 88 is further provided a lever 92 rotatably mounted on the sleeve 83 and connected by means of a spring 93 to the lever 90. The lever 92 is supported on one end of the pawl 89 and holds the latter in the lowered position (fig. 4) in which it is brought by an adjustable stop against the action of a spring 91 on operation of the crank handle 2. The pawl is maintained in said position until it is disconnected from the lever 92 by means of a device which will be later described and returned to the position shown in fig. 3 by means of a spring 91. The lever 92 is provided with an extension 92*a*, on which a finger 95 (fig. 6) abuts at the end of a cycle of the register, that is to say at the end of a full rotation of gear 84. The finger 95 is keyed on a shaft 96 and is given an oscillating movement through a cam at the end of each cycle as hereafter described. A gear 94 keyed on the main shaft 9 (figures 1, 3, 4) is provided with a stop 94*a* fast thereto and coacting with gear 85. When the setting wheel 1 is set on a given amount, that is to say when this wheel is rotated through a certain angle, the main shaft 9 with gear 94 keyed thereon is rotated through the same angle distance and the stop 94*a* is brought to a corresponding angular position. The gear 85 on the movement of the crank handle 2 performs a certain idle rotation according to the position of the stop 94*a* before abutting the latter; the idle rotation to be effected on operation of the crank handle is thus determined by the setting wheel 1. In a similar manner as above described, for the gear 86 is provided a stop 97*a* (figures 1, 5) carried by a sector 97, which is connected to a crosspiece 61 on the drum 60*a*—60*b*—60*c* controlled by means of the handle 62. The connection between sector 97 and crosspiece 61 is not a stiff one; on the contrary these two members are resiliently connected together by means of a spring 98, which holds the stop 97*a* in the ineffective position, that is to say in the position, in which it is out of the path of the finger 95, which is the case when the drum 60*a*—60*b*—60*c* is not set. When said drum is set, the sector 97 abuts a stationary stop 99 thus bringing its stop 97*a* in the effective position.

The amounts of sale, as already said, are arranged in amounts of 2,50 dollars so that, for instance, for an amount of sale between 37,55 and 40.00 a tax amount of 0,80 cents and for an amount of sale between 40.05 and 42,50 dollars a tax of 0,85 dollars should be added. The setting wheel 1 is moved in such manner that both amounts within which the amount of sale is comprised may be viewed one above the other in the glass windows 3. The lowest value of the next higher range (40,05 dollars) is thus 5 cents higher than the highest value of the lower range (40,00 dollars). In order that the same indication of the amount on the indicating drum 14*a*—14*b* may be used in both cases, a small plate 120 bearing figure "5" is disposed in the middle of the window 3 where the cent indication is observable, this plate conceals the last figure of the upper amount (viz. of the lower amount of the range). The amount "40.00" printed on the drum 14*a* as the highest amount (fig. 11) is therefore in the next range the lowest amount "40.05" (fig. 12). The same type "40.00" on the indicating drum 14*a* can thus be used in both cases. The indicating drum 60*a* on the left looking from the front side of the register is connected with the indicating drum 60*c* on the left looking from the rear side of the register and both drums are, as well as a third indicating drum 60*b* connected thereto, loosely mounted on the main shaft 9; the three indicating drums 60*a*, 60*b* and 60*c* are, as it has already been said, controlled through the hand lever 62, independently of the setting effected by the setting wheel 1. The three drums are adapted to set, indicate, print and accumulate the hundred dollar amounts. The big figures 1, 2, 3 . . . observable on the left through the window, make the amounts 100, 200, 300 . . . visible on the front and rear side; the drum 60*b* bear the corresponding tax amounts 2, 4, 6 . . .

Fig. 11 shows an amount of sale between 337,55 and 340, for which a tax amount of 6 plus 0,80=6,80 (drum 60*b*) is indicated, printed and accumulated.

The above described apparatus works as follows: On setting the setting wheel 1, the stops 94*a* and 97*a* are brought into the angular position corresponding to the position of the setting wheel. On the following rotation of the crank handle 2 and gear 84 the levers 90 and 92 are also rotated, the gears 85 and 86 however are not yet rotated and remain in the rest position until the pawl 89 on the lever 90 abuts the stop 94*a* and the pawl 89 on the other lever 90 abuts the stop 97*a* of the sector 97 if the drum 60*a*—60*b*—60*c* has been set. As soon as the clutch 89 abuts its stop, it falls into a notch in the wheel 87 (or 88), which is fixedly connected with the gear 85 (or 86) and throws into rotation the wheel 87 together with gear 85 or the wheel 88 with its gear 86. At the end of this cycle the lever 92 is stopped, the finger 95 abuts the nose 92*a* thus disengaging the clutch 89. At the end of this first cycle, viz. after the first full rotation of the crank handle 2 and gear 84, the gears 85 and 86 have performed a rotation, the angle of which corresponds to the setting of the setting wheel 1. The register is thus ready for the next cycle, which is effected through the next rotation of the crank handle 2.

The fingers 95 are, as it has already been described, keyed on a shaft 96 (Fig. 7), which is given an oscillating movement when the crank handle is operated. For this purpose a crank lever 100 is keyed on the shaft 96 and subjected

to the action of a spring **140**, this lever being locked when the register is inoperative. The shaft **96** is moved at the end of a cycle by means of a pin **101***a* on a gear **101**, which is operated by the crank handle **2**. The pinion **2***a* on the crank handle **2** does not mesh directly with gear **101** but engages a gear **102** (Figures 7, 8) which is fast with gear **101**, both gears being fitted on a common hub.

The gear **102** is provided with an indentation on its whole periphery while the gear **101** is indented only on part of its periphery so that there is a non indented section **101'**. Gear **101** meshes with gear **81** fixed to the secondary shaft **80**; gear **81** is, similarly to gear **101**, deprived of teeth on a section **81'**. Therefore, at the end of a cycle, while the movement of the crank handle **2** is continued and the intermediary shaft **80** after having performed a full rotation through 360° is stopped, gear **101** performs a slight rotation, through which the crank lever **100** is caused to oscillate at the end of the cycle thus rotating the shaft **96** and causing the finger **95** fixed thereon to oscillate so that the pawl **89** is returned into its disengaged position releasing the spring **91**.

The setting wheel **86** is rotated not only when setting the reading drums **60***a*—**60***b*—**60***c* but also on any cycle of the machine for effecting a carrying operation. The springs **91** and **93** of the levers **90**, **92** are so calculated that each of them can move the pawl **89**, so that breakage of a spring does not hinder the working of the register. In order to prevent stopping of the machine through breakage of both springs, a third spring **103** is provided between the lever **92** and a small lever **104** mounted on the same pin as the pawl **89** and acting on the clutch end. This spring **103** can also be independently used, that is to say it can replace the springs **91** and **93**. On breakage of the spring **103** the further working of the register, that is to say printing of the checks would be made prevented owing to the fact that the lever **104** in this case would take its lower position under the action of gravity and centrifugal force and oscillate outwards abutting a stop, which hinders the further movement of the crank handle **2**.

The register is provided with a lock which prevents operation of the crank handle when the setting means are in an undesired intermediary position between two indicating positions and prevents further that during a cycle the setting means may be displaced; the setting means are thus maintained in their position during working of the register. The lock is provided with a three-arm lever **105** (Fig. 7) subjected to the action of a spring **141**. The arm **106** of this lever **105** engaged at its end in the form of a pawl a tooth on a cam **107**, fast on the main shaft and integral with the hub of the crank handle and therefore with the drive pinion 2*a*. The engagement of the pawl in the tooth on the cam **107** prevents rotation of the crank handle. The second arm **108** of the lever **115** bears at its front face on one arm of the lever **100** and moves the latter to the left, so that the other arm of lever **100** is moved away from the path of pin **101***a* on gear **101**. The third arm **109** of lever **105** projects somewhat outwards from the casing **13** and carries a key. On pressing said key, the lever **105** is caused to oscillate in a clockwise direction and the cam is thus disengaged from the lever **105** owing to the fact that the pawl on the arm **106** of lever **105** is disengaged from the tooth on the cam **107**. At the same time the lever **100** is disengaged through the arm **108** of the lever **105**, so that the lever **100** under the action of the spring **140** oscillates on the shaft and its lower end is carried above the arm **108** thus preventing the backward oscillation of lever **105** produced by the spring **141** and locks the lever **105**. Locking of the lever **105** is maintained to the end of the cycle, that is to say until the pin **101***a* of gear **101** abuts a nose on the upper arm of lever **100**, thus causing the latter to oscillate in a clockwise direction on the shaft **96**, so that the lower part of lever **100** oscillates to the left against the action of spring **140** and slides away from the arm **108** thus disengaging the lever **105**, which, under the action of the spring **141** returns to its unlocked position and locks the lever **100** as above described.

The lever **105** cannot oscillate when the setting drums are not in their exact position, which for instance for drums **14***a*—**14***b* is determined by the engagement of a spring pawl **110** in one of the forty notches provided on the periphery of the wheel **94** (Fig. 6), each of these notches corresponding to one of the forty positions of drums **14***a*—**14***b*. The clutch **110** is loosely and rotatably mounted on a shaft **111**, on which is also fitted a locking pawl **112** (Fig. 7), engaging through a stop a pin **109***a* on the arm **109** of the lever **105** as soon as the shaft **111** is rotated. The shaft **111** is thus carried into rotation through the pawl **110**, which slides on the periphery of the wheel **94**, passing from one of the forty notches in the wheel **94** to the next, through the top between two notches and abutting with its nose **110***a* a nose **111***a* on the shaft **111** thus carrying along in its movement the shaft **111** and setting it into rotation when passing on the top of a tooth. A similar pawl acts on the setting of the drum **60***a*—**60***b*—**60***c* on the sector **62***a* of lever **62** (Fig. 5) which is also provided with notches. When one of the two pawls is on the tooth top, viz. between two adjacent notches, the nose on the pawl engages a pin **109***a* and prevents oscillation of the three-arm lever **105**, also when the key provided on the arm **109** of the lever **105** is depressed.

The printing device (Figures 2, 9, 10) is provided with a slide **113** carrying a ribbon and fitted on two pins **114** to the printing position thus remaining constantly in the inserted position. Before the slide is fully fitted in, the crank handle **2** effecting the printing cannot be moved, a projection **115***a* on a lever **115** displacing under the action of a spring **114** a rod **117** articulated at the lower end of lever **115** under the arm **109** of lever **105**. The lever **115** is rotatably mounted on an angle bar **116** secured to the partition **7**. When the slide is fully fitted in, its nose **113***a* causes the lever **115** to oscillate, which thus disengages the rod **117** the latter being left to the action of the spring **144**, which moves the rod **117** away from the path of arm **109**, so that the arm **109** of lever **105** is disengaged and a print is effected at the end of each other rotation of the crank handle.

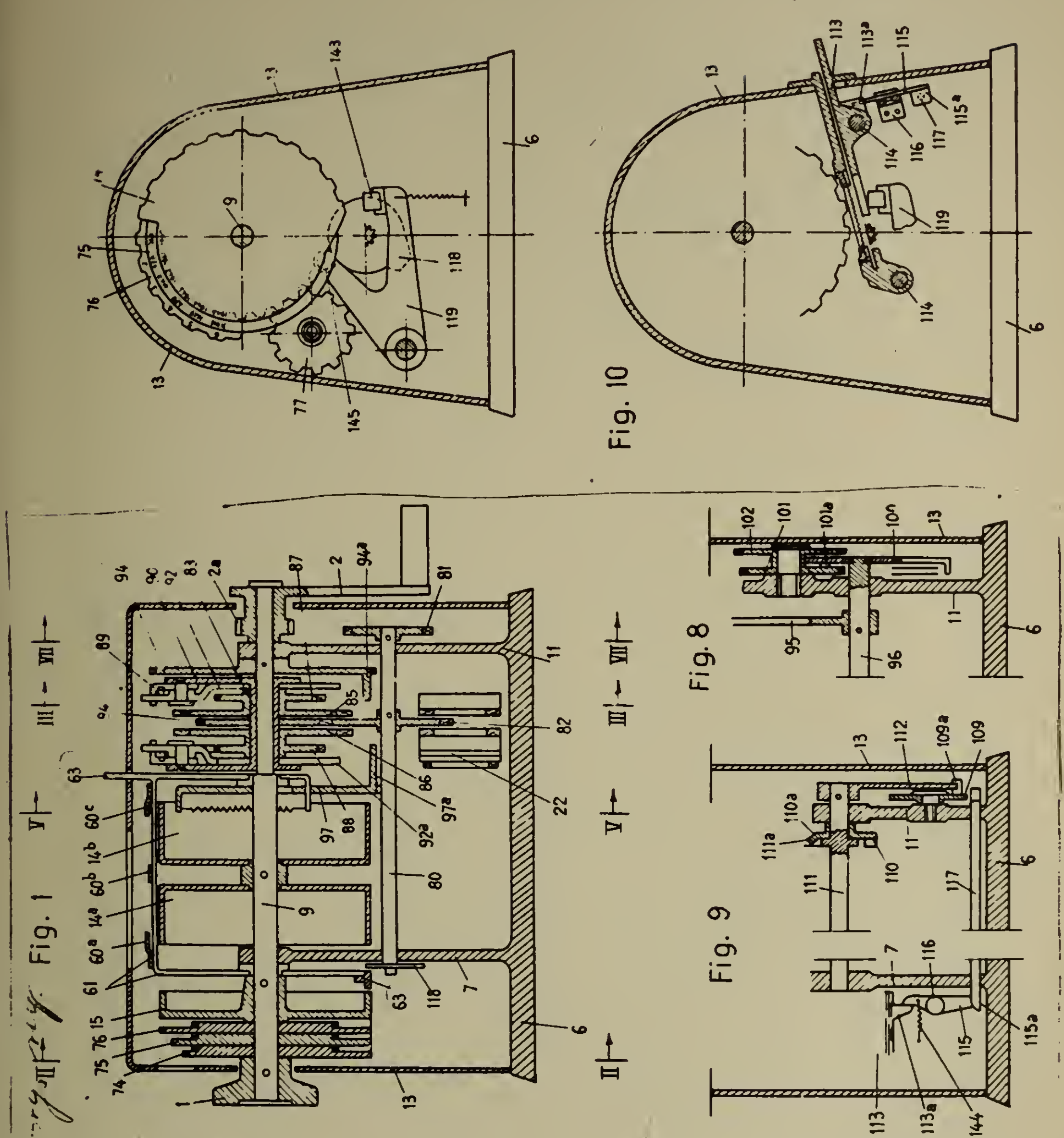
The printing block **143** is arranged on one end of one arm of a crank lever **119**, the other arm of which carries a guiding roller **145** co-acting with a cam **118**, keyed near the partition **7** on the secondary shaft **80**. On rotating the secondary shaft **80**, viz. the crank handle **2**, the raised portion of the cam on passing on the guiding roller causes the lever **119** to oscillate thus effecting printing on the check slipped into the slide by means of the printing rollers **15**

(tax amount) and **74** to **76** (date). The ribbon may be movable or stationary.

The indicating device is constituted by an indicating drum **60***a*—**60***b*—**60***c* passing in front of a glass window in the casing **13**. The indicating drum **15** is rotatably connected to the main shaft and is thus rotated on rotation of the setting wheel **1**. The indicating drum carries forty amounts of sale increasing by 2,50 (0 to 2,50; 2,55–5.00; 5,05–7,50 etc) and the corresponding proportional tax amounts (5, 10, 15 . . . etc. cents), so that on setting the setting wheel **1** the amount of sale and the corresponding tax amount can be viewed by the customer through the window **3**. The subdivision of the indicating drum and the mechanisms for accumulating and printing the tax amounts may obviously be modified at will and any other number of amounts of sale and tax may be used; the members (wheels, segments) provided with notches should in this case have a number of notches corresponding to the number of amounts.

BIAGIO BERIA.

PUBLISHED	B. BERIA	Serial No.
MAY 25, 1943.	CASH REGISTER	403,580
BY A. P. C.	Filed July 22, 1941	2 Sheets-Sheet 1



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Serial No.
403,580
2 Sheets-Sheet 2

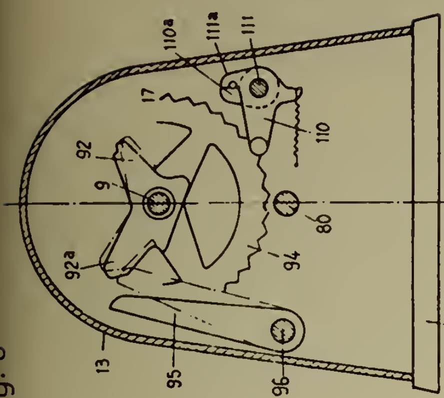

Fig. 6

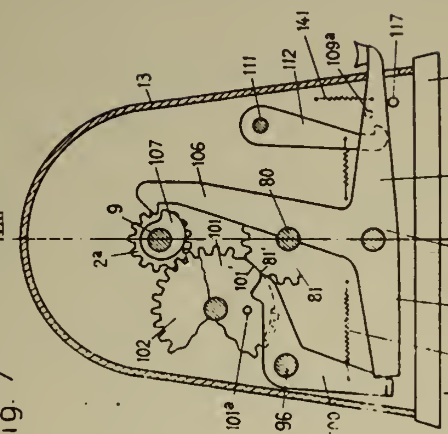

Fig. 7

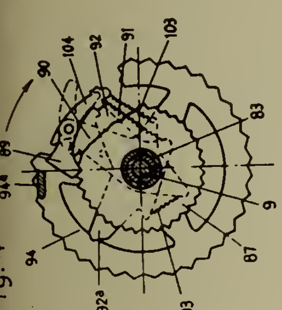

Fig. 4

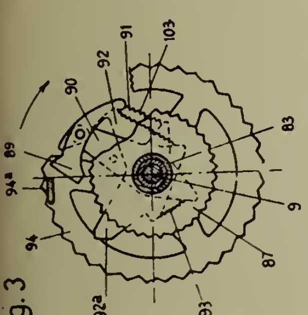

Fig. 3

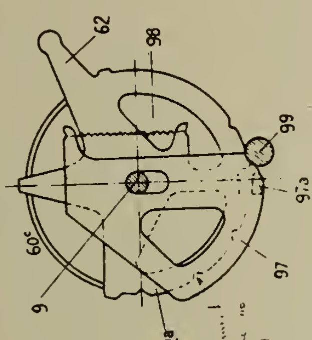

Fig. 5

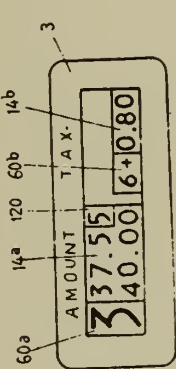

Fig. 11

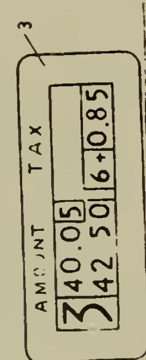

Fig. 12

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ALIEN PROPERTY CUSTODIAN

AIRCRAFT PLANE

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This invention relates to an aircraft plane with means for variation of the characteristics of the wing profile.

In one known wing construction of this type adjustable wing noses are provided for increasing the chamber of the profile and the lift. In another wing construction a stationary or movable auxiliary front wing is provided in front of the aircraft plane which is fixedly connected with the fuselage, forming a slot between the auxiliary front wing and the main wing, whereby tearing of the boundary layer is retarded.

It is an important object of the present invention to provide a wing construction permitting sensitive adjustment and variation of the profile characteristics within a wide range.

With this and further objects in view, which will be hereinafter set forth, according to the invention the wing or aircraft plane is provided with an auxiliary front wing and a movable wing nose which permits adjustment of the camber of the profile. The auxiliary front wing may be fixedly connected with the main wing and the parts may be so arranged that in one end position of the movable wing portion the same together with the auxiliary front wing and the fixed main wing forms a substantially closed, unitary profile, while on movement of said wing portion towards its opposite end position a slot is formed between said wing portion and the front wing.

Generally, still more favourable conditions are obtainable by providing the front wing to participate in the motion of the movable wing nose or leading edge. In this case, a mechanism may be provided for automatically advancing the front wing for formation of a slot as the movable leading edge is swung towards deeper camber. The adaptability can be increased by constructing the adjusting mechanism for the front wing so as to permit adjustment of the front wing relatively to the hinged leading edge independently of the adjustment of said edge.

The above mentioned steps have a particularly favourable effect in connection with wings having a lifting flap at or near their trailing edge, as known per se.

The air or gas current resulting in the slot between the auxiliary front wing and the hinged leading edge may be supported by an additional current discharged from one or more blow-out slot in the front wing.

The characteristics of the wing profile may be further improved by the provision of slots in the vicinity of the lifting flap and of the aileron, as known per se.

The invention will be better understood by reference to the following detailed description in connection with the accompanying drawings showing by way of example and purely schematically some embodiments of the invention, ylz—

Fig. 1 is a perspective view of an airplane including supporting planes having the invention applied thereto.

Fig. 2 is a cross sectional view of the wing, on line II—II of Fig. 1, on a larger scale.

Fig. 3 is a cross sectional view on line III—III of Fig. 1, on a larger scale.

Fig. 4 is a cross sectional view through a modified form of a wing on a line corresponding to line II—II of Fig. 1, on a larger scale.

Fig. 5 is a cross sectional view through another modification of a wing on a line corresponding to line II—II of Fig. 1, on a larger scale.

Fig. 6 is a section on line VI—VI of Fig. 7, showing a detail of Fig. 5.

Fig. 7 is a section on line VII—VII of Fig. 6.

Fig. 8 is an elevation, showing another detail of Fig. 5.

Fig. 9 is a section on line IX—IX of Fig. 8.

Similar characters of reference denote similar parts in the different figures.

Referring now to the drawings in greater detail, and first to Fig. 1, it will be noted that the fuselage **1** of the aircraft includes a cockpit **23**, a propeller **2** and tail surfaces **3**. Main wings **4** are fixedly connected on both sides of the fuselage and at their trailing edges are fitted with outer ailerons **5** and inner lifting flaps **6**. A continuous slot **7** extends from end to end of each wing adjacent to the aileron and the lifting flap.

The construction of the wings will be better seen from Figs. 2 and 3, showing two spars **8** and **9** carrying the covering **10** which in transverse direction is supported by ribs **11** arranged at intervals along the wing and serving, moreover, to support a shaft **12** for adjustment of the ailerons **5** and the lifting flaps **6** through arms **13** fixedly mounted on shaft **12**, and rods **14** co-operating therewith.

According to this invention, the forward portion of wing **4** forms a self-contained unit, making up a so-called front wing **15** which in the embodiment shown in Figs. 2 and 3 is rigidly connected to the main wing **4** by means of continuous ribs **46** extending to the extreme leading edge.

Provided between the front wing **15** and the main wing **4** are movable wing noses or portions **16**. As shown in Fig. 1, two portions **16** are provided for each wing **4**. The portions **16** are suitably constructed as torsion proof tubes which are stiffened by ribs **17** and hinged about a joint **18** at the lower side of main wing **4** for downward swinging. In the upper portion of portion **16** its upper edge **47** comes to lie under the planking **10** of the main wing, the contours of the profile portion of the part **16** adjacent to the edge **47** being shaped to conform to a circle about joint **18** in the region covered by the planking **10** and the remainder of the profile of part **16** being shaped to form a closed unitary profile together with the front wing **15** and the main wing **4** in the upper

position of wing nose 16. A shaft 19 supported in the ribs 11 of main wing 4 serves to adjust the hinged leading edge or wing flap 16 through levers 20 on shaft 19 and connecting rods 21 jointed to the ribs 17 of flaps 16 at 22. The shaft 19 extends into the cockpit 23, as indicated by the dot and dash lines in Fig. 1, for operation by any suitable driving mechanism, for example, a worm and worm wheel system, not shown.

If the wing noses 16 are swung downwards, slots 48 are formed between these noses and the front wings 15, whereby in flight an air current is produced which passes upwards through these slots 48.

The stationary front wing 15 on its walls facing the hinged flaps 16 is fitted with blow-out slots 24 adapted for the discharge of compressed air or exhaust gas which may be directed into the front wing 15 from the fixed main portion of wing 4 through the channel formed by the hollow bridge portion 49, Fig. 1.

By blowing air or gas through the slots 24, the current in the slots 48 between the front wings and the hinged flaps 16 is promoted and the effect of the front wing 15 is enhanced. If desired, the air discharged from slots 24 may be sucked on through slots 7 in the aft portion of the wing, for instance, by means of a pump 50, shown in Fig. 2 as shifting air from the space to the right of spar 9 into the space to the left thereof, through aperture 53 in the spar 9. A centrifugal pump or any other suitable type of pump may be used for this purpose; or, an ejector operated by the exhaust gas of the engine may be used. The air then passes through apertures 51 in spar 8, channel 49, and apertures 52 in rib 46 into the front wing 15, for discharge from slots 24. If desired, the exhaust gas may be discharged directly through the slots 24 of the front wing, while the sucking on through slot 7 may be effected by means of an additional blower, for instance, the engine blower, delivering the suction air to the engine.

Referring now to the embodiment shown in Fig. 4, it will be noted that the auxiliary front wing 30 in this case is not rigidly connected to the main wing 4, but movably mounted by connection to the wing portion which is referred to as the hinged wing nose and in Fig. 4 is designated with 33. In the embodiment shown in Fig. 4, rods 31 are fixedly mounted on front wing 30 and slidable in guide members 32 on intermediate partition walls or ribs 54 of the wing portion 33 which in turn is hinged to ribs 55 of the main wing 4 at 36. Moreover, a control rod 34 is jointed at 56 to front wing 30 and with its opposite end is jointed to the main wing 4, at 35, whereby the front wing 30 is automatically spread off from flap 33, as will be hereinafter described.

The adjacent surfaces of flap 33 and main wing 4 are shaped to conform to a cylinder whose axis is at the fulcrum 36 of flap 33, as indicated by radius r. Since the fulcrum 36 in this case unlike Figs. 2 and 3 is not located at the rear edge of the hinged portion 33, an angular recess is produced between the portions 33 and 4 as the leading edge of flap 33 is swung downwards. In order to prevent the air flow from being disturbed by this recess, a covering flap 37 is hinged to flap 33 at 57 to swing about an axis which is parallel to the axis of joint 36, under action of an upward pull exerted by a helical spring 38. By way of alternative, flap 37 may be springy in itself.

A shaft 58 mounted in bearing brackets 59 on spar 8 and adapted to be operated from the cockpit, as described with reference to the preceding figures, serves for moving flap 33 through arms 20 on shaft 19 and connecting rods 21 jointed at 22 to ribs 54 of wing flap 33. It will be obvious that on downward swinging of flap 33, the auxiliary front wing 30 will be spread from flap 33, by action of control rod 34, forming between front wing 30 and wing flap 33 a slot 60. On return of flap 33 into the straight position for high speed flight the auxiliary front wing 30 is withdrawn by rod 34 to contact flap 33, thus forming a unitary, self-enclosed profile with parts 33 and 4.

Referring now to the embodiment illustrated in Figs. 5 to 9, it will be noted that the joint 41 connecting control rod 34 for front wing 30 with the main wing 4 in this case is not fixedly secured to wing 4, like joint 35 in Fig. 4, but is mounted for sliding along the lower contour of the profile, as best seen from Figs. 6 and 7, in which 61 is the covering of wing 4, 62 is a slot therein and 63 is a slide member which by two spaced screws 64 is connected with a second slide member 65, parts 63, 64, 65 making up together the joint 41 of Fig. 5, to eyelets 72 and 73 of which the control rods 44 and 34 are jointed, by pivot pins 70 and 71, respectively. It should be noted in this connection that the control parts 20, 21, 22 and 32, 31 may be mounted in the central region of flap 33 and front wing 30 in two or more geometrical planes indicated by dot and dash lines at 66 and 67 in Fig. 1, while a pair of rods 34 is jointed at 56 to the opposite end walls 68 of front wing 30, as best shown in Fig. 7. The slot 60 between wing nose 33 and front wing 30 is also shown in Fig. 7. It will be understood that the mechanism shown in Figs. 6 and 7 is illustrated purely schematically since the practical design is obvious from these figures to one skilled in the art. Metal linings 69 or reinforcing plates may be provided on both sides of the planking 61 within the moving range of joint 41. The control rods 44 are operated from levers 43 on a shaft 42 which is coaxially mounted within shaft 19, as shown in Figs. 8 and 9. In order to permit independent operation of the shafts 19 and 42 from the cockpit, the outer shaft 19 is interrupted at the points where levers 43 are mounted on shaft 42, the driving connection between the adjacent portions of shaft 19 being established, for instance, by a coupling sleeve 74 which is recessed at 75 as shown for permitting unhampered relative motion of the shafts 19 and 42 through a maximum angle a.

By forward or rearward shifting of joint 41 it is possible to advance and withdraw the front wing 30 independently of the motions of wing flap 33. It follows that front wing 30 can be speed from flap 33 even if the latter is in its upper or high spread position for slight camber. Moreover; this arrangement permits front wing 30 to be held in engagement with flap 33 also in the downwardly swung position of the latter for deep camber. In other words, any desired width of slot 60 between front wing 30 and flap 33 can be adjusted with any position of flap 33, thus permitting a sensitive, continuous variation of the characteristics of the profile. Reference numerals 76 denote lightening holes in the ribs.

The method and apparatus of the present invention have been described in detail with reference to specific embodiments. It is to be understood, however, that the invention is not limited by such specific reference but is broader in scope and capable of other embodiments than those specifically described and illustrated in the drawing.

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L. BÖLKOW
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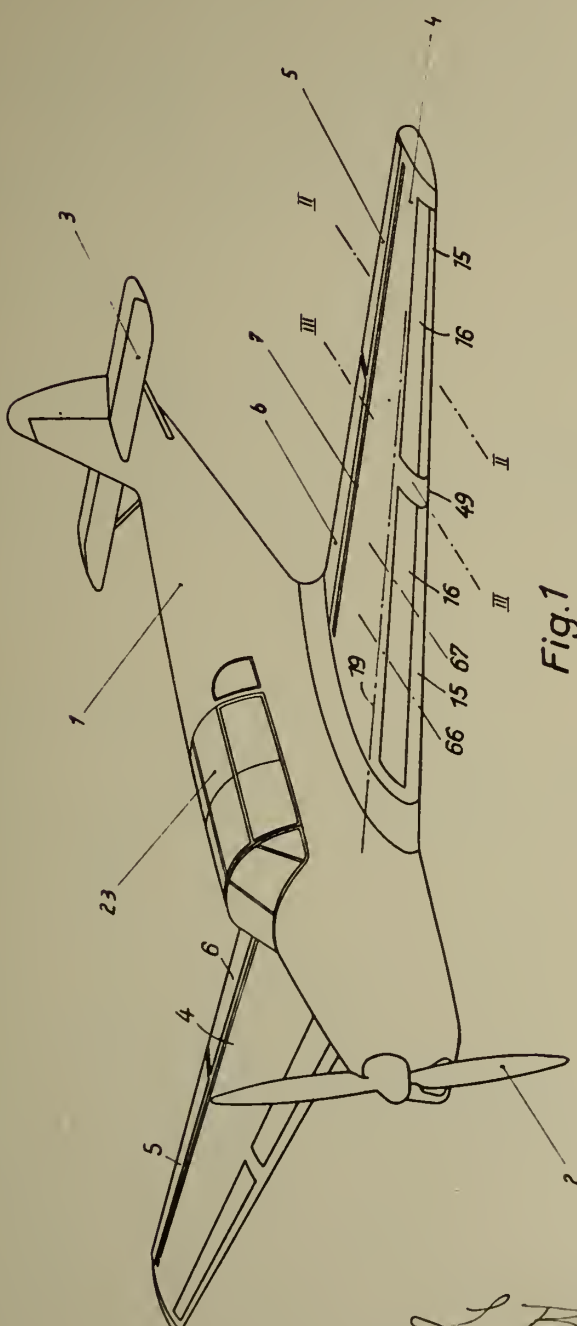

Fig. 1

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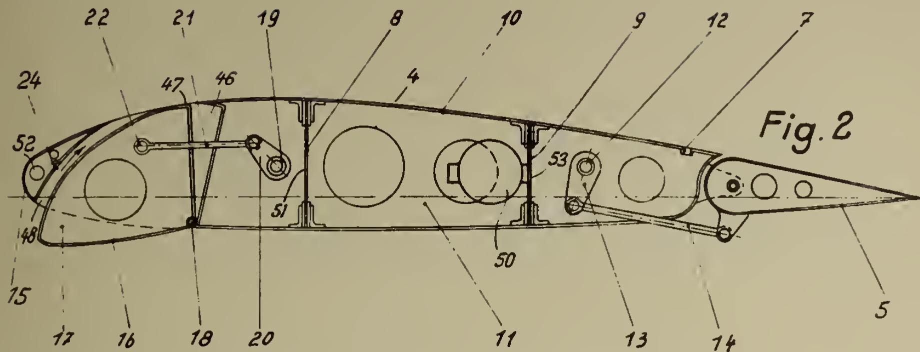

Fig. 2

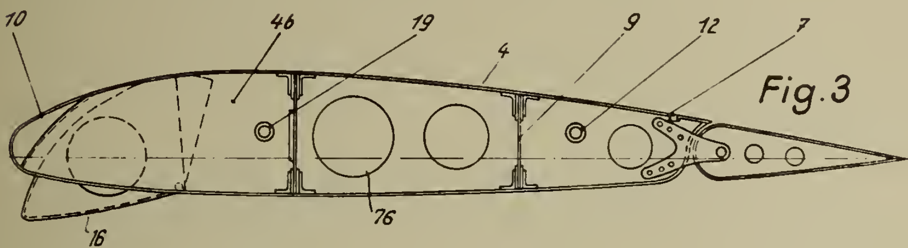

Fig. 3

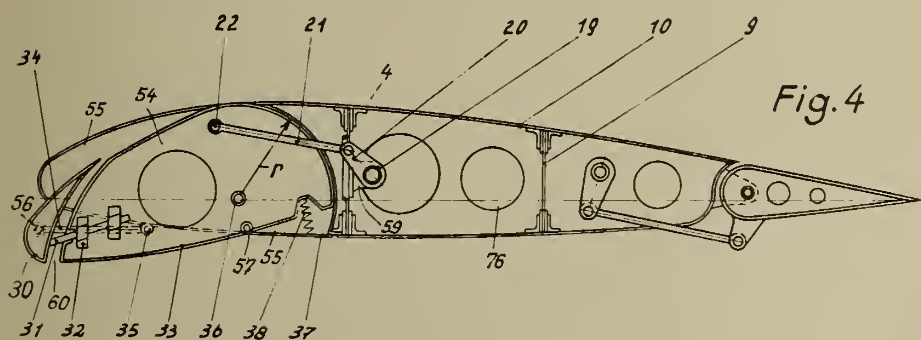

Fig. 4

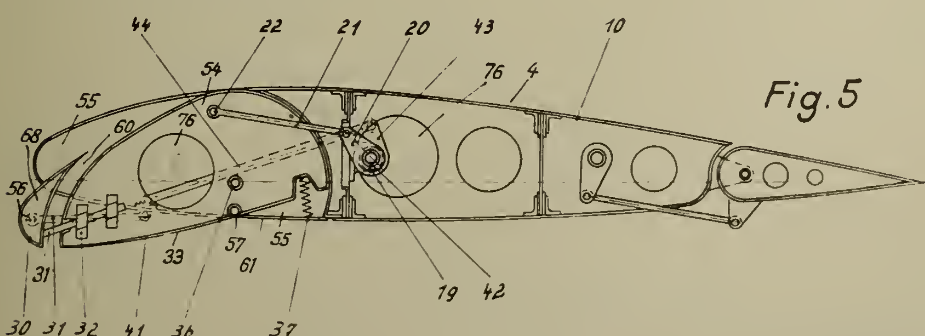

Fig. 5

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Fig. 6

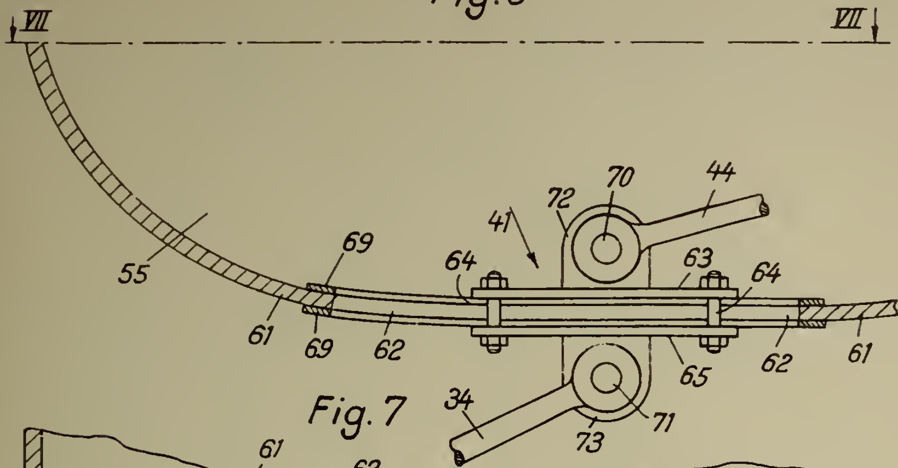


Fig. 7

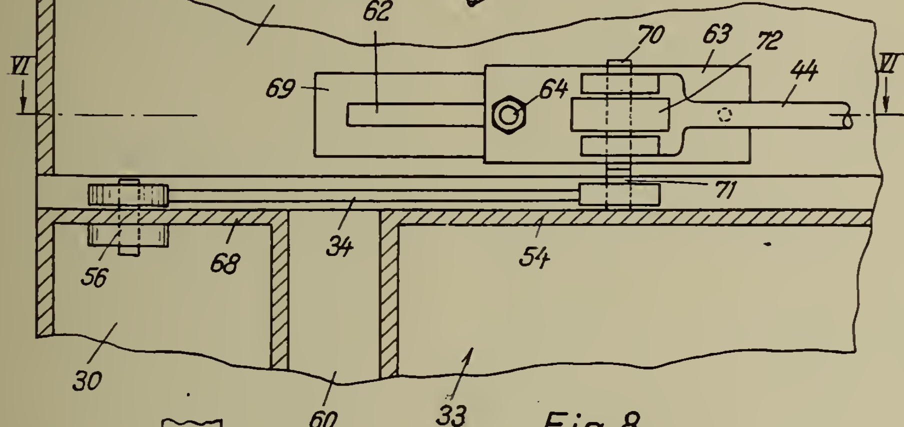


Fig. 9

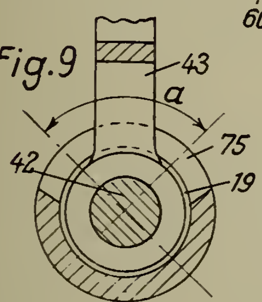
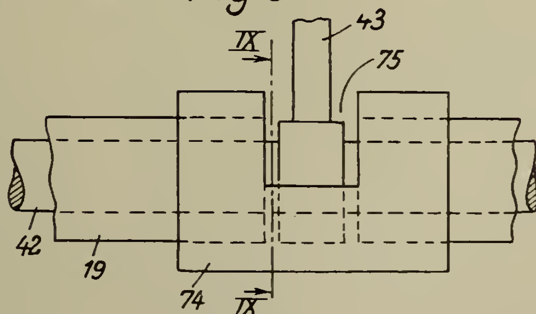


Fig. 8



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ALIEN PROPERTY CUSTODIAN

DEVICE FOR NEUTRALIZING THE INERTIA OF A VEHICLE BODY

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Application filed July 31, 1941

This application is a division of my application Serial Number 288,214, filed August 3, 1939.

The chief object of this invention is to provide a device for neutralizing acquired speed or momentum in order to avoid harmful or undesired consequences of such speed or momentum, for example, such as arise in the event of sudden reduction of speed or sudden stopping of moving masses such as motor vehicles, engines, cars, airplanes, etc.

This neutralization applies not only to the vehicular or other mass as a unit, but also to any mass being carried upon such unit or within it, as for example loose goods, baggage, and passengers, as well as being applicable to trailers and other connected trains of vehicles.

By this invention, the harmful consequences which naturally follow an abrupt reduction in speed are automatically eliminated regardless of the suddenness of slowing down or stopping. A motor car, for instance, running at its maximum speed (100–150 km. per hour or faster) can be stopped as abruptly as its brakes will permit, without any disturbing or harmful shock to passengers or injury and destruction to itself or goods being carried upon it, in the manner hereafter explained.

The theory upon which the present invention proceeds is the following:

Assume a certain mass to be moving upon a moving surface (belt)—the mass traveling in one direction while the surface on which it is running is traveling in the opposite direction. Now, when the relative speeds of the moving mass and the moving surface are so synchronized that they are equal, but in opposite directions, the moving mass will appear to a stationary observer to be at a standstill. In the same manner, the freight or passengers being carried upon a mass moving as described,—notwithstanding the fact that said freight or passengers have a speed corresponding to the acquired speed of the moving mass,—will not exhibit as regards the stationary surroundings any of the consequences of inertia, in view of the apparent immobility of the mass, so long as its forward momentum becomes neutralized by the surface upon which it is running, said surface moving in the opposite direction with an equal power and speed.

Now, to place beneath the wheels of a moving mass or a mass moving on rails, a surface moving in the opposite direction, at a time when it would be desired to offset the effects of acquired speed and inertia, is not only impractical but, even if practically possible, would bring results directly contrary to those aimed at; for it would be most undesirable to bring abruptly into frictional contact two powerful forces moving at fast speeds in opposite directions. Before the desired synchronization would be effected, there would occur a violent shock with injurious consequences.

However, by the present invention as hereinafter explained, it becomes possible to neutralize, completely and without danger, the consequences of acquired speed and inertia, basing the invention on the theory above described; because the oppositely moving surface is already installed between the mass whose momentum is to be affected, and the chassis upon which said mass is mounted, as will be explained in connection with the drawings.

In short, then, the general object of this invention is the elimination of accidents in connection with any type of vehicle, inasmuch as it makes possible the most complete and abrupt braking without danger of destruction or injury to the moving mass or the freight being carried, and without danger of death or injury to passengers. It also becomes possible to prevent striking any obstacles or pedestrians.

A collateral object of the invention is to make possible the landing of an airplane in an extremely short distance after the wheels touch ground, for it enables the most complete braking of the plane's wheels without danger of the overturning of the plane. It also enables a plane to take off in a short distance as will be explained hereinafter.

With the foregoing objects in view, the invention comprises a moving surface or belt moving in a direction opposite to that in which the vehicle is proceeding. Said surface is placed between the chassis of the vehicle and its body,—the body being the mass whose acquired speed and inertia is to be neutralized. As applied to an airplane, the moving surface is placed between the undercarriage and the body of the plane.

Beneath the body of the vehicle or the airplane I attach sets of small wheels and when the body of the vehicle or plane, after sharp braking, tends to roll forward even slightly on small rollers which are placed between the chassis and the body, these sets of small wheels come upon the above-mentioned moving surface which is moving in the opposite direction. When those small wheels come into contact with the oppositely moving surface and roll upon it, the body or mass ceases its tendency to surge forward, because this forward motion is smoothly absorbed

or neutralized by the action of the oppositely moving surface.

To give a particular example, consider the application of the invention to an automobile—with the sudden braking of the car, only the chassis and engine, including the radiator and transmission system, are abruptly halted; the body and its appurtenances, including fenders, engine and radiator covers, are allowed to surge forward slightly, (by means of the above-mentioned rollers) so that this weight, including any passengers or freight that may be thereon or therein, is taken up from the oppositely moving surface through the small sets of wheels. As the rapidly moving surface receives the weight of the body, its opposite action neutralizes or absorbs the forward running of the body—that is, although the body is still presumably rolling forward, the oppositely running surface prevents the body of the car from gaining any ground, for this oppositely moving surface has the tendency to push and carry the weight back so that, when there is the necessary synchronization, depending on the rapidity of the moving surface in relation to the traveling speed of the vehicle, there immediately occurs complete neutralization of the acquired speed and momentum, without any danger to the vehicle, or its passengers or freight. The synchronization referred to above may be aided and made faster and better by light spring action between the chassis and body as hereinafter explained.

It may be noted that, in view of the rollers referred to above, it will not be necessary for the oppositely moving surface to bear the entire weight of the body, for a good proportion of the weight towards the rear of the body will be carried upon these rollers, and only the forward weight of the body will come to bear on the oppositely moving surface.

The power necessary to activate the oppositely moving surface may be derived from the engine of the vehicle. Thus, immediately upon the application of the brakes, all the engine's power is available for the working of the moving surface. However, various other activating forces such as compressed air or any other type of force independent of the force which drives the vehicle may be used for driving the moving surface. If the power is taken from the driving engine of the vehicle, the necessary amount is negligible and in no way detracts from the needed power for forward drive.

It is also a feature of the invention that means will be provided whereby on the one hand, the chassis and body may be automatically joined and held rigidly together during normal driving, and, on the other hand, whereby there may be effected the automatic release of the body (which will tend to surge forward and be carried upon the moving surface), from the chassis (which will remain absolutely stationary) on sharp emergency braking.

With reference to the application of the invention to an airplane, for landing purposes, the object and nature of the invention are the same as in all other vehicles in general; there is provided however an additional landing wheel to be placed toward the nose of the plane (or any other equivalent provision) so that the shift in the center of weight of the mass may be neutralized, and danger of overturning avoided, when the loose-moving body of the plane surges forward ahead of the undercarriage. The system of oppositely moving surface belts, comprising this invention, will be installed between the undercarriage and the body of the airplane, with the moving surfaces attached to the undercarriage, and the small sets of wheels to carry the body of the plane upon these running surfaces attached to the underside of the body.

In addition, it is necessary for the undercarriage, including this forward additional wheel, to be installed on a type of chassis upon which the body of the airplane will rest. The body of the plane can be fastened to, or loosened from, this chassis at the proper time and manner as was above described for the other types of vehicles. All the other provisions as to attachment and operation are exactly the same as described for the other vehicles.

There will be hook attachments to effect the automatic and rigid holding together of body and carriage at the proper times, and also to effect the immediate release of these two elements, exactly as provided for in the application of the invention to automobiles and other vehicles.

As concerns the taking off of an airplane with a view to avoiding the necessity of using a long distance for the take-off, the invention itself accomplishes a result which, though somewhat different from the embodiment of the invention as applied to vehicles, nevertheless is a result inherent in the very nature of the invention as described above. In other words, whereas, in landing, the invention is utilized to accomplish the neutralization of momentum and inertia and thus make possible the stopping of the airplane quickly and safely, in taking off, the invention allows the mass to accumulate an immense power of energy and forward motion, the while keeping the airplane motionless; this developed momentum is at the proper moment set free by relaxing the action of the oppositely moving surface and the airplane smoothly assumes a high speed.

It is well to explain at this point exactly how the invention would be applied in connection with the take-off of airplanes. When, by the use of any feasible method, we prevent the forward motion of the undercarriage, and allow the motor to run and the propellers to turn, the body of the plane will tend to surge forward (rolling on the small rollers placed between undercarriage and body), and will be carried forward onto the oppositely moving surface by the small sets of wheels attached to the body. So long as the propellers continue to turn, these small wheels keep turning in the direction the plane is facing, but the action of the oppositely moving surfaces prevents the body of the plane from moving forward in respect to the ground, while the speed of the moving surfaces is maintained at the proper ratio to the speed of the small wheels. When the body of the plane, now running upon the moving surface, attains the desired speed and momentum, the action of these surfaces is relaxed and at the same time the undercarriage is freed so that the plane may roll forward. The body will then pull the undercarriage rapidly forward and the plane will continue its forward progress running along the ground with a speed corresponding to the running speed or momentum it acquired while still running on the moving surfaces.

In accordance with another aspect of the invention the moving surface could be provided at a landing field or in the deck of an airplane carrier and then an airplane without any special structural features could land in a relatively small space, the tendency of the airplane to continue along the ground or deck being neutralized

by the oppositely moving surface in accordance with my invention.

It may be added that also in accordance with the present invention there may be achieved the speedy and opportune stopping of a vehicle or train of connected cars independently of a driver's particular ability or capacity, in a certain situation, to apply the brakes. According to this aspect of the invention, the automatic stopping of a vehicle or train of connected cars is accomplished by a special fender or bumper which can be placed at the front end of the vehicle, or of each car in a train, which bumper can act instantaneously on the brakes, directly such bumper receives a sufficient specified pressure to force it backwards. The sudden stop achieved in this manner will not have harmful consequences due to the provision of the neutralizing device of the invention.

Finally, with reference to the particular aspect of the invention set forth in the previous paragraph, and also with reference to the invention generally, there may be provision for effecting braking of a vehicle or train of vehicles without the usual slipping of the wheels; this is accomplished by the provision of chucks or any other type of wedge, which can be automatically inserted and withdrawn, at the proper time and in the proper manner, between the front end of the wheels and the road surface or trail rails.

One of the principal features of the invention resides in an airplane wherein a forward propelling force or inertia may be built up in the fuselage of the airplane to assist in taking off from the ground and also to arrest forward inertia of the airplane when landing.

With the above and other objects in view which will appear from the detailed description below the invention is shown as applied particularly to an automobile and an airplane. It is obvious that the invention is capable of many embodiments and the drawings show only a preferred method of construction.

Referring to the drawings:

Fig. 1 is a side elevational view of my improved airplane, the same being shown in a normal position in full lines and in a forwardly tilted taking off position in dotted lines.

Fig. 2 is a fragmentary bottom plan view.

Fig. 3 is an enlarged fragmentary side elevational view with parts broken away in section.

Fig. 4 is a horizontal sectional view on the section line 32—32 of Figure 3.

Fig. 5 is an enlarged detail vertical longitudinal sectional view on the section line 33—33 of Figure 4.

Fig. 6 is an enlarged vertical longitudinal sectional view on the section line 34—34 of Figure 4.

Fig. 7 is an enlarged vertical longitudinal view on the section line 35—35 of Figure 2.

Fig. 8 is a detail vertical transverse sectional view on the section line 36—36 of Figure 7.

Fig. 9 is a detail vertical transverse sectional view on the section line 37—37 of Figure 7.

Fig. 10 is a vertical longitudinal sectional view through a tread-mill device showing my improved airplane positioned thereon for taking off.

Fig. 11 is a top plan view with parts broken away in section of the tread-mill device illustrated in Fig. 10.

The invention, as applied to an airplane, will now be described and in the different figures similar reference characters are used for like elements.

The numeral 110 designates a fuselage of the improved airplane which includes an inner frame structure 111 which is free of the main landing gear 112. The landing gear 112 includes the usual pair of opposed wheels 113—113 and upwardly diverging shock absorbing struts 114—114 at opposite sides of the landing gear structure. The struts 114—114 extend into the fuselage and are fixedly connected to a frame structure, which frame structure includes bearings 115—115 which are slidably mounted on rods 116—116 extending lengthwise of the fuselage and secured at their ends to the frame structure 111. Equalizing springs 117 and 118 respectively abut the opposite ends of each bearing 115 and the other ends abut collars fixedly secured to the rods 116. Thus it will be seen that the landing gear 112 is slidably connected to the rods 116—116 for back and forth sliding movement. As previously mentioned, the bearings 115—115 are fixedly secured to a frame or carriage disposed adjacent the sides of the fuselage and each frame or carriage is designated by the letter A. A transverse drive shaft 119 has its ends journaled in the two frames or carriage structures A—A and this shaft is driven by gearing 120 carried by a frame 121 splined to and slidable longitudinally upon a drive shaft 122. Fixed to the shaft 119 and disposed within the frame structures A—A are pulley wheels 123 over which belts 124 pass, the said belts also passing over pulley wheels 125 rotatably carried by shaft 126 mounted in the forward ends of the frames A—A. Underlying the top leads of the endless belts 124 is the top lead of a plurality of chains 127 which pass over sprocket wheels 128. A platform 129 underlies the top lead of each set of chains and each chain is provided with a plurality of closely spaced anti-friction rollers 130' with which the top lead of the endless belt 124 engage.

The aforementioned chains, belts, driving pulleys, and sprockets, are enclosed in a housing B which is integral with the fuselage 110 and fixedly mounted to the housing B directly above each set of driven endless belts 124 are a set of three rollers 130, the said rollers being normally out of riding engagement with the belts 124 when the weight of the airplane is off the ground for there is a slight vertical movement between the landing gear 112 and the frames A—A.

The endless belts 124 are adapted to be driven in unison in the direction of the arrows shown in Figure 3, that is the movement of the top lead of the belts is in a forward direction and in view of the fact that the body or fuselage of the airplane is supported on the belt by the engagement of the rollers 130 therewith, there will be a tendency for the entire body or fuselage to shift forward relative to the landing gear. The power for imparting movement to the belts may either be through the engine E of the airplane or by means of an auxiliary electric motor M which is mounted rearwardly of the engine and upon the housing B (see Figures 3 and 7), the shaft 131 of the engine E is in axial alinement with the driving shaft 132 of the electric motor M and these shafts carry driving gears 133 and 134 respectively, either of which may be brought into meshing engagement with a gear 135 forming part of a gear transmission 136 which connects either of the driving shafts 131 and 132 with the longitudinally extending shaft 122, the latter having the universal joint 137 therein due to the fact that the frames A—A have a slight vertical up and down movement. Any conventional manual control such as shown in Figure 3 of the drawing and designated C may

be employed for selective shifting either of the gears 133 and 134 into engagement with the gear 135, depending upon whether the power for the shaft 122 is to come from the engine E, or from the auxiliary motor M. When the engine E is used as a source of power from the shaft 122 and the plane is at rest, the pitch of the variable propeller P may be adjusted to zero so that the propeller may rotate without exerting a forward propelling movement. When the motor M is resorted to as a source of power for the rotation of the shaft 122, the same may receive its electricity from a cable D which is releasably connected by a plug and socket connection F, and which connection is broken when the forwardly moving plane reaches the length of the electric supply cable D.

Mounted forwardly of the main landing gear 112 is an auxiliary landing gear 140, the same including a frame 141 having a landing wheel 142 mounted on the outer end thereof. The inner end of the frame 141 includes a pair of inclined rails 143 over which sets of rollers 144 ride, the said rollers being carried by a frame 145 forming part of the frame structure 111 of the fuselage. The frame 141 is provided with a pair of bearings 146 which slide on rods 147 extending lengthwise of the fuselage and which rods are fixed to the frame structure 111. Equalizing springs 148 engage the ends of the bearings 146 and collars fixed on the rods 147. The springs 148 normally hold the landing gear 140 in the position shown in Figure 3 of the drawings, but this landing gear permits the fuselage to shift forward when the wheel 142 is upon the ground, as illustrated in dotted lines in Figure 1 of the drawings. The airplane assumes this forwardly tilted position after either the motor M or the engine E has been thrown into operation to drive the endless belts 124, it being remembered that at that time the friction between the belts and the rollers 130 causes the fuselage to shift relative to the landing gear 112 and in the shifting, the forward end of the airplane is overbalanced, at which time the auxiliary landing gear 140 touches the ground and the fuselage is permitted to shift relative to the landing gear 140 by reason of the rollers 144 and track rails 143.

It will be seen that if the brakes are applied to the wheels 113 of the main landing gear or if the wheels are forwardly chucked, momentum may be stored up in the fuselage of the airplane prior to taking off and which force acts to facilitate the ready ascent of the airplane when the brakes are released and the pitch of the variable propeller P is adjusted for flying condition.

When landing, it will be seen that the motor M or engine E may be operatively connected with the shaft 122 for driving the endless belt 124 and as the wheels of the landing gear touch the ground, the moving belts and rollers 130 coact to resist any forward thrusts or inertia which may be present in the body of the airplane, thus permitting the plane to land without undue shock to the plane and its occupants.

In Figures 10 and 11 of the drawings, I have illustrated the take off platform for an airplane constructed in accordance with that hereinbefore described. In these figures, a platform 150 is countersunk in the ground or runway and mounted in a portion of the platform is a tread mill 151 on which the wheels of the landing gear of the airplane rest preparatory to taking off. The tread mill includes a series of driven endless belts 152, the top lead of which travels in the direction of the arrows shown in Figure 10 and which belts pass over pulleys 153 mounted on shafts 154. Underlying the top lead of the belts 152 are chains 155 similar to the chains 127 hereinbefore mentioned and which chains ride over a platform 156. One of the shafts 154 is driven through a belt and pulley connection by an electric motor 157 and this motor is controlled by a hand operated rheostat R. It will be seen that when the airplane is rolled upon the tread mill 151 and the inertia devices within the airplane have been operated to cause the auxiliary landing gear 140 to move down, the tread mill 151 may be started and the variable propeller B adjusted for taking off and the movement of the tread mill counteracts the normal tendency of the airplane to travel forwardly, until such time that the propeller has reached a speed sufficient to impart a lifting of the airplane, at which time the tread mill 151 is shut off and the airplane is then free to move forwardly and rapidly rise in the air.

While the invention has been described above with reference to an airplane, it is obvious that the invention is capable of general application.

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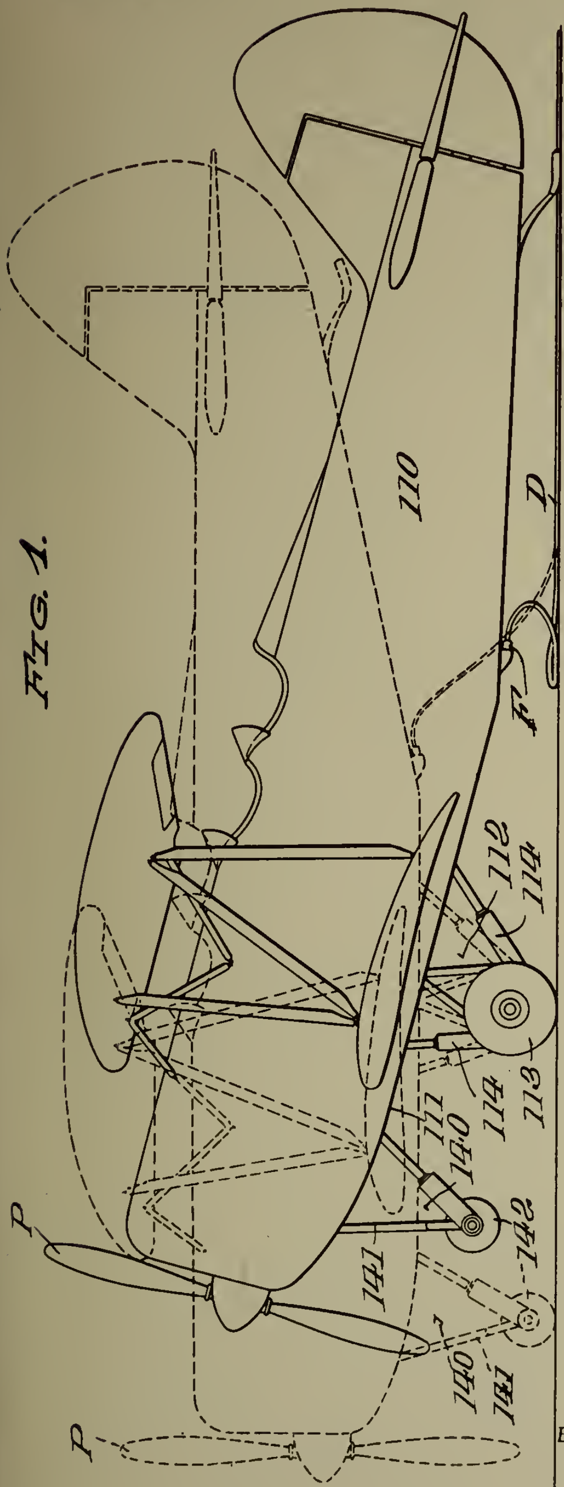
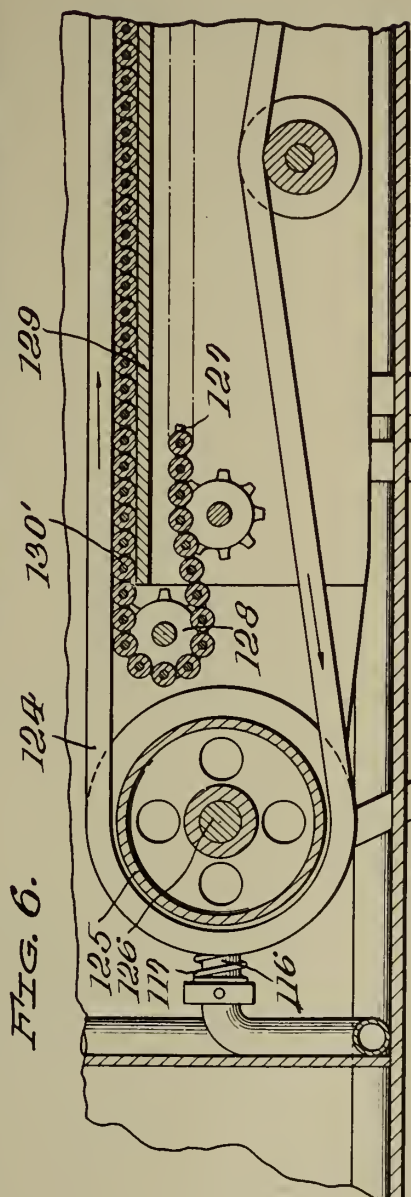
6 Sheets-Sheet 1





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6 Sheets-Sheet 2

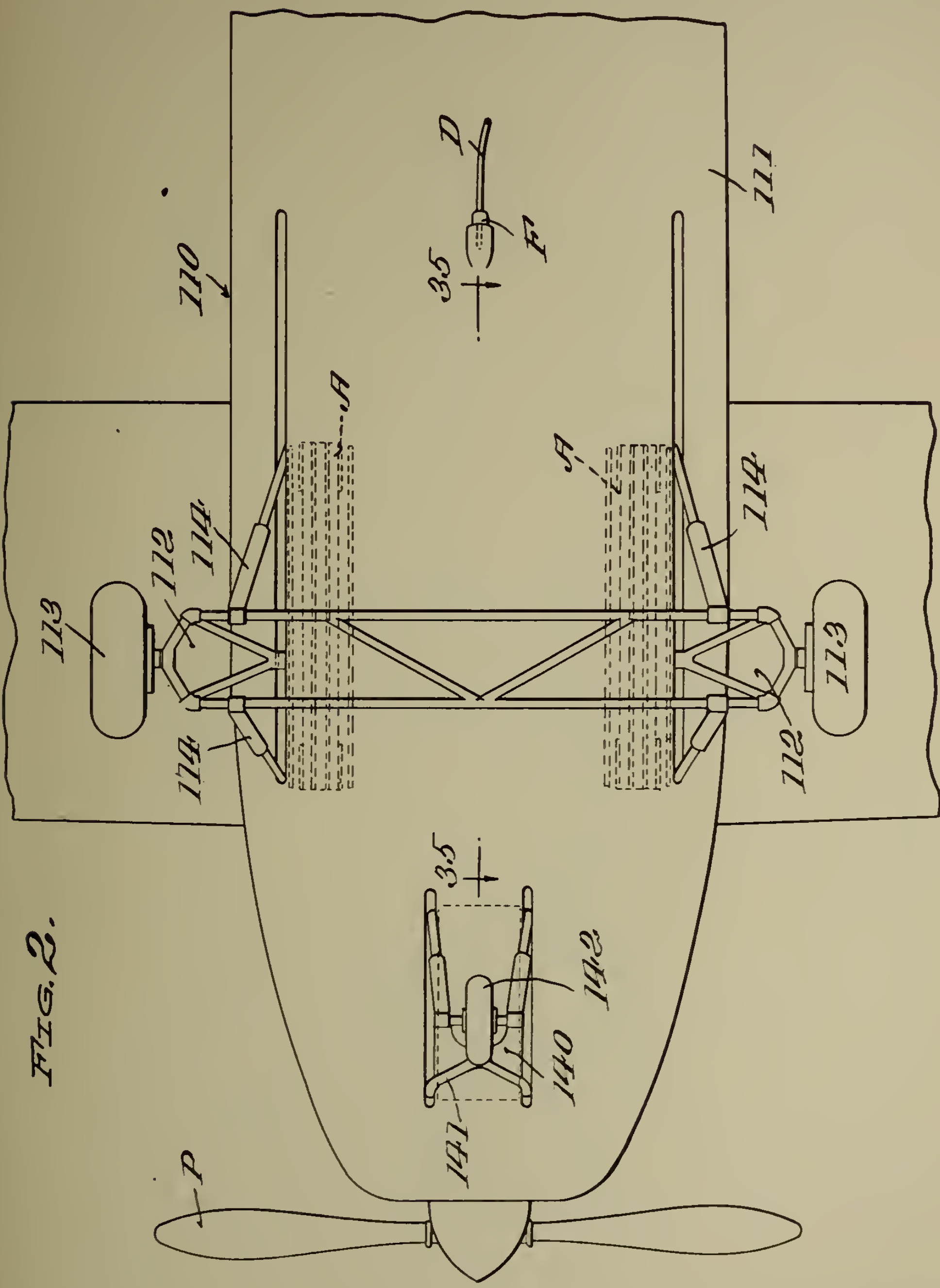

FIG. 2.

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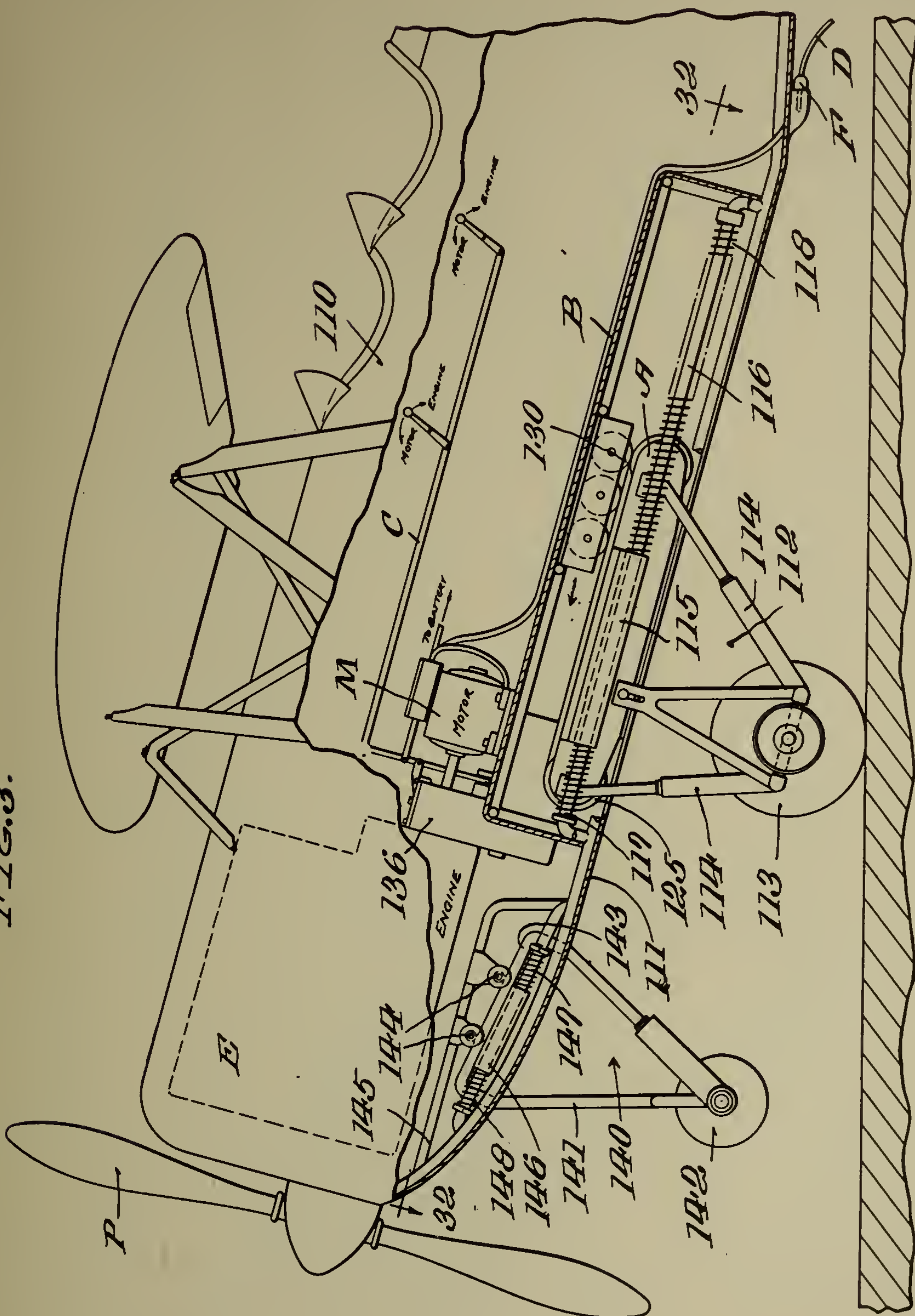
FIG. 3.



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6 Sheets-Sheet 4

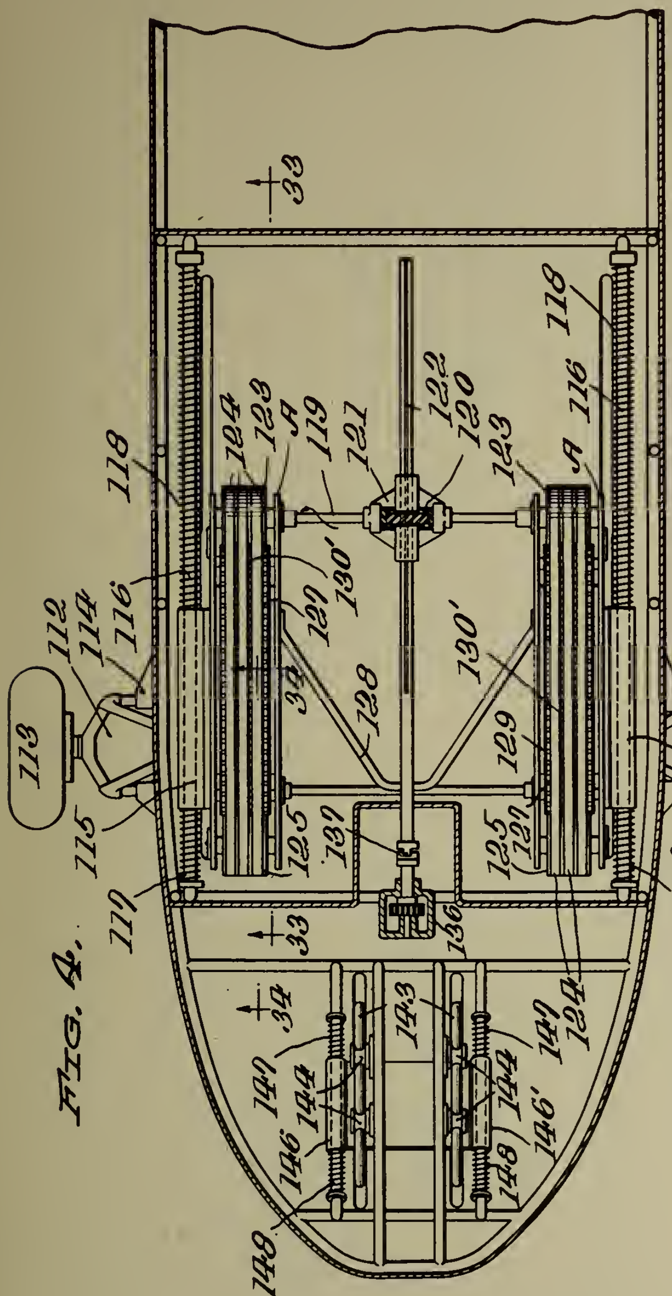

FIG. 4.

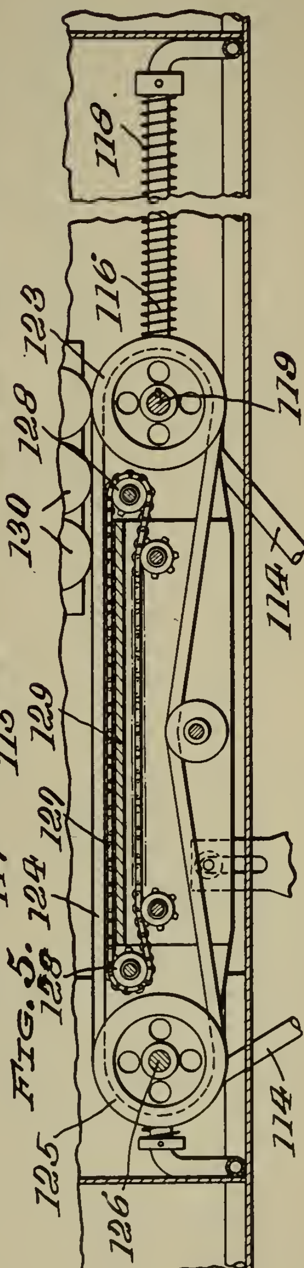

FIG. 5.

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D. A. APOSTOLOU
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OF A VEHICLE BODY
Filed July 31, 1941

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404,951

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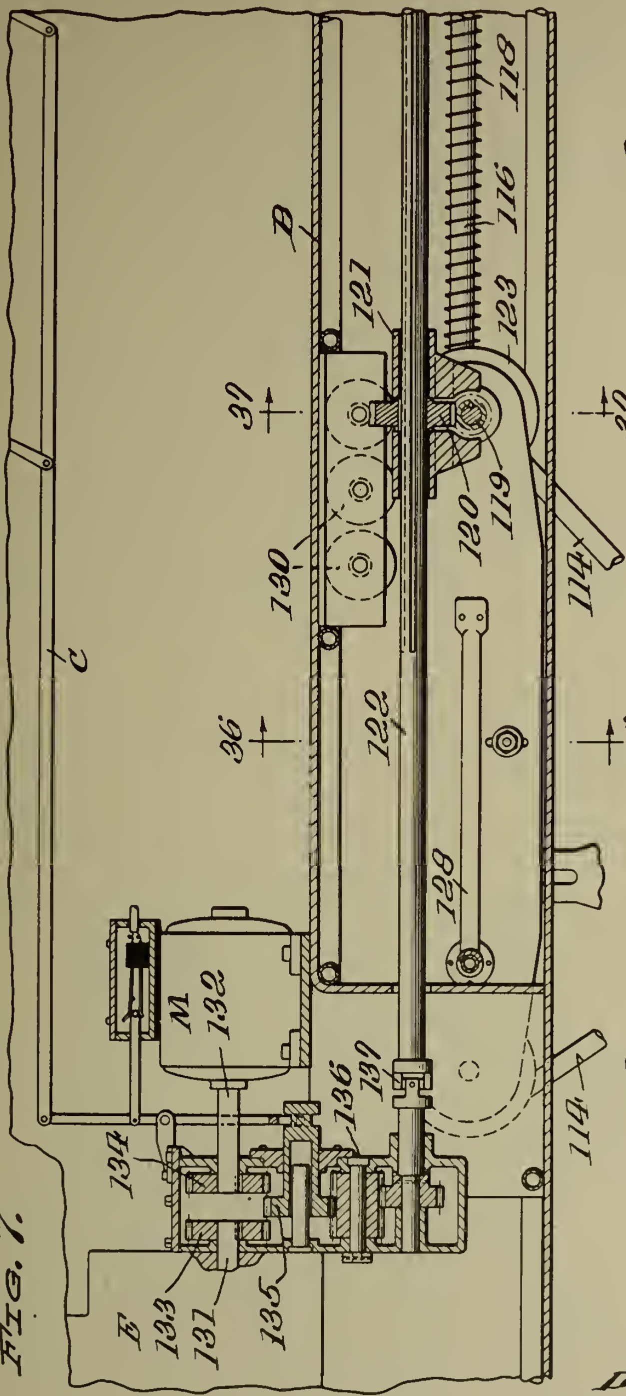

FIG. 7.

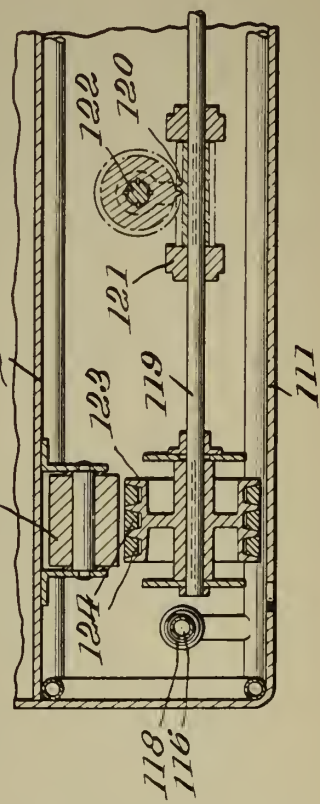

FIG. 9.

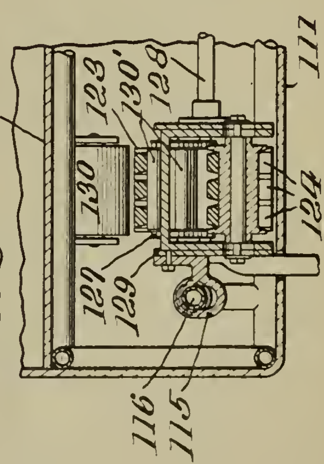

FIG. 8.

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FIG. 10.

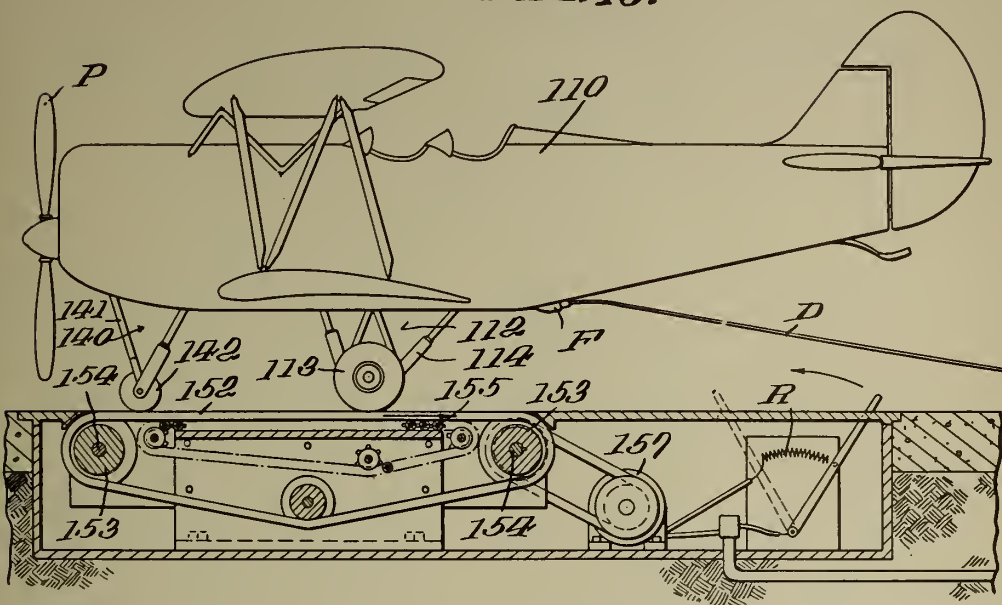
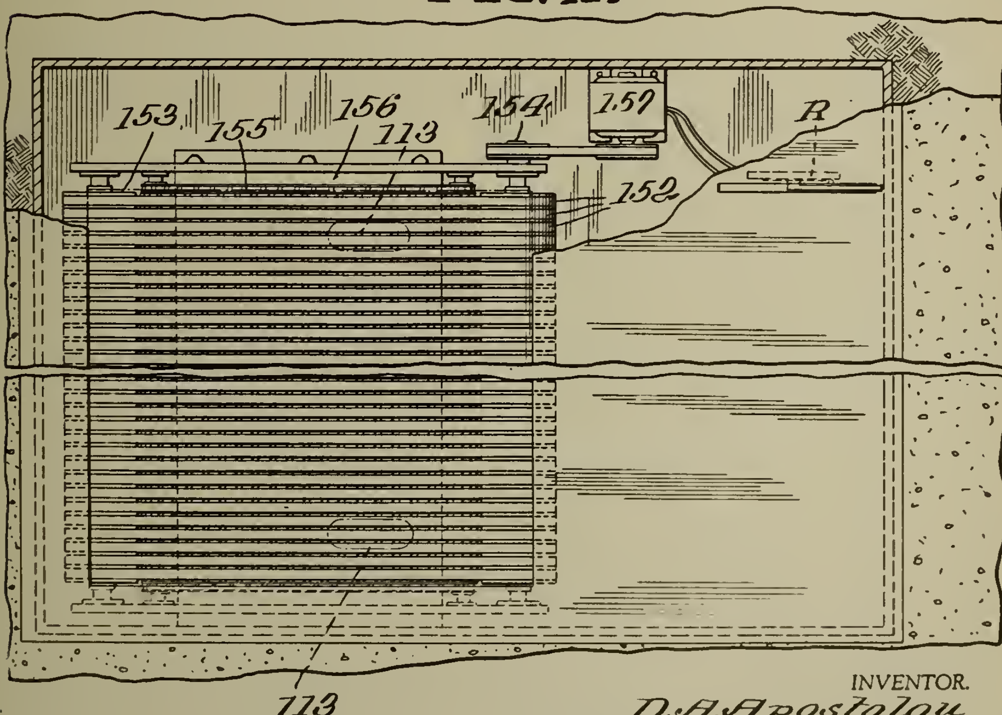


FIG. 11.



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ALIEN PROPERTY CUSTODIAN

REELS OR SPOOLS FOR MOTION PICTURE FILMS

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Application filed August 4, 1941

The invention relates to improvements in reels or spools for motion picture films and particularly is directed to novel means for attaching the film to the core of the reel or spool.

The principal object of the invention is to secure the end of a motion picture film, regardless whether the film is ready for projection or is still light sensitive, in such manner to the core of the reel or spool that already during the formation of the first winding the film is securely fastened. At the same time the film is adapted to be released automatically from the reel or spool during its unwinding movement, without any sudden jerk when the end of the film separates from the core, so that a tearing of the film or any other injury to the same is avoided.

The prior attempts and proposals to solve the above problems have not been very successful, because the film was either not attached with sufficient security to the core and caused the film to slip, or the film was attached too firmly, with the result that upon an unwinding of the film the latter is subjected to great mechanical stresses when the end of the film separates from the core of the reel or spool.

It is an object of the present invention to overcome these disadvantages by dividing the core of the reel or spool in axial direction in two parts and mounting one of the parts movable with respect to the other part which is fixedly attached to the flanges of the reel or spool, so that the end of a film which is inserted between the two parts is adapted to be clamped in position when the movable part of the core is actuated by the film during the winding of the same on the core.

Another object of the invention is to mount the movable part of the divided core of the reel or spool rotatable about an axis or axes parallel to the axis of rotation of the reel or spool, so that the movable part of the core can readily be rotated by the film to be attached to the core.

Other objects of the invention will be apparent or will be specifically pointed out in the description forming a part of this specification, but the invention is not limited to the embodiments of the invention herein described, as numerous other forms may be adopted within the scope of the claims.

Referring to the drawings which illustrate by way of example several embodiments of the invention:

Fig. 1 is a cross sectional view of a film reel, with the section being taken through the core of the reel;

Fig. 2 illustrates the position of the movable part of the core when a film is wound on the reel;

Figs. 3 to 8 show each a different embodiment of the core of the reel;

Figs. 9 and 10 illustrate a portion of a reel or spool provided with a modified embodiment of a film clamping device in inoperative and operative position respectively;

Figs. 11 and 12 illustrate a modification of the clamping device of Figs. 9 and 10, in inoperative and operative position respectively.

Figs. 13 and 14 show in sectional view and plan view respectively another modification of the clamping device, similar to Figs. 9 and 10;

Figs. 15 and 16 illustrate another embodiment of the clamping device of the invention;

Fig. 17 is a sectional view along the line 17—17 of Fig. 15;

Figs. 18 to 20 illustrate another type of the clamping device according to the invention;

Figs. 21 to 26 show different embodiments of a clamping device in which the movable core member is formed by a lever of the second class; and

Figs. 27 to 29 show different views of a film reel with a clamping device of still another construction.

Fig. 1 illustrates a film reel provided with a cylindrical core divided along a plane parallel to the reel axis 4. The flanges 1 of the reel are fixedly attached to the larger part 2 of the core, while the smaller part 3 of the core is pivotally mounted about an axis 5, the ends of which are supported by the flanges 1. The space or slot 6 between the adjacent plane faces of the core parts 2 and 3 preferably is not much wider than the thickness of the standard motion picture film.

Fig. 2 illustrates diagrammatically the attachment of the film to the core of the reel. The end of the film 7 is inserted into the slot 6 until it reaches the other end of the same as shown at 8. Then the film 7 is wound first about the movable core part 3 and then about the fixed core part 2 and thereby rotates the former about the axis 5 and clamps the end of the film firmly between the two core parts. The arrow 9 in this figure indicates the winding direction of the film.

Preferably, the dimensions of the movable part 3 of the core are made such that the first portion of the first winding of the film forms a flush continuation of the circumference of the fixed part 2 of the core, i. e. no step is formed where the film leaves the slot 6 and passes along the circumference of part 3. This result is obtained

by making the radius of curvature of the curved face of part 3 somewhat smaller than the radius of curvature of the curved face of part 2, namely about the thickness of the standard motion picture film.

Fig. 3 illustrates a modified construction of the core of the film reel. The plane face of the movable part 3 of the core is provided with a slant 10 of such inclination that the end of the film is not clamped merely along a line between the parts 2 and 3 when the latter is rocked about its pivot axis 5, as in Figs. 1 and 2, but is clamped securely between two plane areas.

In the Figs. 3, 4, 5, 7 and 8 the movable part of the core, as shown in solid lines, indicates the position in which a film is held securely attached to the core, while the dotted lines indicate the position of the movable part of the core prior to the insertion of the film into the slot of the core.

Fig. 4 illustrates the present invention as applied to the core of a relatively large film reel. In reels of this type the core is made larger and preferably hollow to save on material. In order to employ the present invention the hollow core 11 is cut open, so that a fixed part 12 and a movable part 13 is produced. The movable part 13 is attached to a block 14 made for instance of wood, which is pivotally mounted about an axis 15, the ends of which are supported by the flanges of the reel. In similar manner a block or filling 16 is arranged in the fixed part 12 of the core, so that a narrow slot 17 is formed between the parts 14 and 16 in which the end of a film may be inserted to be clamped in position as described in the foregoing.

Fig. 5 illustrates an embodiment of the invention in which the end portion of the film inserted in the slot of the core is engaged uniformly by the entire plane face of the movable core part 3 and clamped against the fixed core part 2. This is accomplished by links 18 which are pivotally attached at 19 to the movable core part 3 and at 20 to the fixed core part 2. Both parts 2 and 3 of the core are recessed at 21 and 22 respectively, to provide free movement of the links 18 so that the movable core part 3 is able to clamp the end of the film against part 2 when the film 7 is passed around the curved circumference of part 3.

Fig. 6 illustrates a modification of Fig. 5, in that the movable part 3 of the core of the reel is attached to the fixed part 2 of the core by pairs of links 23 and 24 which are mounted in the same manner as the single links 18 by means of pivot pins 19^a and 20^a respectively. In this figure the part 3 as illustrated in solid lines shows the inoperative position of part 3, while the dotted lines indicate the position of the part 3 when the film is clamped in the core.

Fig. 7 illustrates a modification of Fig. 2, in that the movable part 3 of the core is provided with arm-like extensions 25 pivotally attached to the axis 4 of the reel. In this embodiment also, the movable part 3 is provided with a rounded edge at 26 so as to prevent too sharp a bend in the film at this point when the film, after having been inserted in the slot 6, is wound around the core. Obviously, the movable core parts 3 of the other embodiments may be similarly provided with a rounded edge.

Fig. 8 illustrates an embodiment, which as far as the result is concerned is similar to the Figs. 5 and 6. In this case, however, the movable part 3 of the core is provided with a pair of parallel inclined slots 27, 28 through which pass the two rods 29, the ends of which are fixed to the flanges of the reel. It will be clear that when the film is inserted in the slot between the core parts 2 and 3 and then is wound around the part 3, that the latter moves automatically from the dotted line position into the position illustrated in solid lines in which the film is clamped firmly in the core.

In order to facilitate in the embodiments of Figs. 1 to 7 the release of the film from the core of the reel when the film is unwound, the invention contemplates the employment of small helical springs, which are to be arranged on the axes 4, 5, 15, 19, 20, 19^a and 20^a in such manner, that after the unwinding of the last winding of the film the movable part 3 of the core is urged positively away from the fixed part 2 of the core, thus releasing the end of the film in the slot 6 immediately. In Fig. 8 the employment of small leaf springs is considered advisable for the last mentioned purpose. These springs may be mounted in the slots 27, 28 in such manner that after the unwinding of the last winding of the film the part 3 is pushed away from the fixed part 2.

It is also within the scope of the invention to arrange the aforesaid helical springs and leaf springs respectively, in such manner that normally the movable part of the core of the reel is urged into operative clamping position toward the fixed part of the core.

Furthermore, the surface of the two parts of the core, which come into clamping contact with the end of the film, may be roughened or even may be provided with undulations or ridges in order to increase the friction which in the clamping position of the core holds the end of the film.

The above described constructions of the core permit a secure clamping of the end of the film only in one direction of winding, and when it is desirable or necessary to effect a secure clamping of the film selectively in both directions of winding a somewhat different construction of the film clamping means has to be employed, as will be described hereinafter.

In accordance with another object of the present invention the fixed and movable part of the core of the reel or spool may be arranged and constructed relatively to each other in such manner that the insertion, attachment and release of the film for winding and unwinding respectively, is possible in both directions of rotation of the reel or spool. The Figs. 9 to 20 illustrate various embodiments of a film reel of this type.

Fig. 9 illustrates a portion of a film reel as it is used for motion picture projectors. The part 30 of the core is fixedly attached to the flanges 31 of the reel and is provided with a radical recess 32 in which is pivotally mounted about an axis 33 the movable part 34 of the core. As illustrated in this Fig. 9, the movable part 34 is positioned in a neutral or inoperative position and so to speak is divided by the radial plane X—X in two equal sections. Fig. 9 illustrates also how the end of the film 7 is introduced into the clamping device formed by the side walls 35 of the radial recess 32 and the movable part 34. It will be noted that the film 7 is inserted into the recess 32 until it reaches the bottom 36 of the same, which is sufficient to insure a firm clamping of the film as soon as the film is wound in the direction of the arrow 37 about the core. When this is done the upper narrow end 39 of the part 34 tilts toward the right and its lower enlarged

end 40 is moved toward the left and clamps the end of the film against the left hand side wall 35 of the recess 32. Preferably, the movable part 34 is so arranged in the recess 32 that in its neutral position the narrow end 39 projects somewhat beyond the outer circumference of the core, and in its tilted operative position lies about flush with the same. In case it is desired to wind the film in the opposite direction on the reel the end of the film is inserted in the right hand side of the recess 32 to be clamped by the part 34 against the right hand side wall 35 of the recess 32, as will be obvious from the Fig. 9. In such cases where the movable part 34 is almost completely inserted in the radial recess 32 it is advisable to make this part 34 of such shape and form that its center of gravity will be positioned between the center of the reel and the pivot axis 33.

Fig. 10 illustrates an embodiment of the invention which differs from Fig. 9 only in the shape of the recess which accommodates the movable core part 30. In Fig. 10 the radial recess 32 is provided with a curved bottom 36^a which has the advantage that the end of the film makes a better frictional contact with the clamping faces, in that the contact takes place over a larger area and not only along a line.

The Figs. 11 and 12 illustrate a modified embodiment of the clamping means in which the end of the film is not directly clamped by the movable part 41 against the walls of the recess 32, but by means of leaf springs 42. These springs 42 engage the film 7 over an larger area and insure a better clamping engagement, and have the additional advantage that the film is not damaged by any rubbing engagement with the clamping faces. The upper or outer end of the part 41 is provided with inclined faces 44 which guide the end of the film into the narrow space between the side walls 35 of the radial recess 32 and the springs 42. The free upper end of the leaf springs 42 project into narrow slits 45 of the part 41 near the pivot axis 46 thereof. Fig. 11 shows the position of the movable part 41 during the insertion of the film, and Fig. 12 shows the part 41 in operative clamping position.

The Figs. 13 and 14 illustrate a modification of the device shown in Fig. 9, in that an additional element 48 is provided which indicates the required direction of rotation of the reel when the end of a film has been inserted in the clamping device. The element 48 has the form of a short lever whose one end is pivotally attached at 50 to the upper end of the movable part 34 and whose other end is adapted to be received loosely and selectively in any one of two grooves 52 provided in the fixed core part 30 adjacent the upper ends of the recess 32. It is believed to be obvious, that when the lever 48 lies in the right hand groove 52 (Figs. 13, 14) the film 7 can only be inserted in the left hand side of the recess 32 and has to be wound clockwise about the core in order to effect a clamping of the end of the film inserted in the clamping device. On the other hand, the film 7 has to be inserted in the right hand side of the recess 32 when the lever 48 has been reversed so as to lie in the left hand groove 52.

The Figs. 15, 16 and 17 illustrate a clamping device in which the pivotally mounted part is returned positively to its neutral or inoperative position by the film upon unwinding the same. The pivotally mounted part of the clamping device is composed of a cylindrical member 54 having attached at each end a plate 55 and rotatable about an axis 56 which is eccentrically located with respect to the center axis of the cylindrical member 54. The upper or outer ends of the two plates 55 are connected with each other by two spaced parallel rods 57 between which the film 7 to be attached to the reel is inserted. The Figs. 15 and 16 illustrate clearly how the film 7 is gripped by the clamping device and in what manner the film will actuate the pivotally mounted clamp member to release the clamping device when the film is unwound from the reel.

The Figs. 18 and 19 disclose an embodiment of the invention which is particularly suitable for rollfilm spool and any other type of spools having a relatively small core. The movable part 3 of the core is made somewhat larger with respect to the fixed part 2 than in the previously described embodiments, but still renders it possible to insert, clamp and release the film 7 in either direction of rotation. It will be noted that the movable core part 3 is provided with a convex clamping face 58 which urges the film against the cooperating plane clamping face 60 of the other core part 2 fixedly secured to the spool flanges 1. In both Figs. 18 and 19, the dotted lines indicate the operative clamping position of the movable core part 3 when holding a film wound on the spool in opposite direction respectively, as indicated by the arrows 61 (Fig. 18) and 62 (Fig. 19).

Fig. 20 illustrates a modified embodiment of the clamping means shown in the Figs. 18 and 19. In this Fig. 20 the pivotally mounted part 3 of the core of the spool is larger than the part 2 which is fixedly attached to the flanges 1 of the spool, and the pivot axis of the part 3 may coincide with the axis of rotation 4 of the spool as shown.

In the above described embodiments of the invention the film is attached or clamped to the core of the reel or spool by means of a lever of the first class i. e. a lever pivoted between its ends, one end of which is actuated by the film, while the other end clamps the film against the cooperating part of the core. It is, however, also possible to employ as a movable part of the core a lever of the second class comprising a single arm which is pivotally mounted at one end near the bottom of the recess in the core, whereby the film is clamped against either wall of the recess by a portion of the latter between the pivoted end and the outer end over which the film passes while being wound on the core.

The Figs. 21 to 26 illustrate various embodiments of the invention employing a lever of the second class.

According to Figs. 21 and 22 a member 63 which is pivotally mounted about an axis 64 is provided with an opening 65 in its center, through which the end of the film 7 is passed before it reaches the clamping area 66. The two separated portions 67 and 68 of the member 63 are connected with each other by thin side plates 69, the space between the latter is just sufficient to accommodate the width of the film (Fig. 22). In the embodiments of the Figs. 21, 22, 25 and 26 the side plates 69 of the pivoted member 63 are arranged adjacent the flanges 70 of the reel or spool, while the Figs. 23 and 24 disclose a modification in which the side plates 69 are arranged in the same plane as the flanges 70, which latter are provided with suitable cut-outs 71 to accommodate these side plates 69.

The Figs. 25 and 26 illustrate a modified embodiment in which the pivoted member is pro-

vided with means for facilitating the insertion of the film and for effecting a positive release of the end of the film after unwinding. This means comprises two spaced parallel rods, tubes or the like, designated with 72, which are employed in place of the single bar-like portion 68. During the winding of the film the latter passes over one of the rods 72 and thereby tilts the member 75 in a manner to clamp the end of the film against the wall of the radial recess, and during the unwinding of the last portion of the film the latter engages the other rod 72 and thereby rocks the member 75 positively into its release position.

When treading a film into the clamping devices of the above described embodiments of the invention, it is assumed in case of film reels, that the relatively large flanges of the same are provided adjacent the clamping device with a sufficiently large aperture through which the operator may reach with his fingers to seize and manipulate the end of the film which is to be secured to the core of the reel.

Such a manipulation of the film during threading is sometimes inconvenient and cumbersome and in cases of this kind the following arrangement may be used to better advantage in which the movable part of the core of the reel or spool is mounted in such manner that upon insertion of the film in the recess of the fixed part of the core and rotation of the reel the movable core part moves automatically into operative clamping position.

According to Figs. 27 to 29 the core 78 of the reel 79 is provided with a radial recess 80 whose two walls 81 are arranged at an acuate angle to each other. A pivotally mounted clamping member 82 of elliptical or substantially elliptical cross section is positioned in this recess 80 with its long axis normally in a radial plane of the reel. Fig. 27 illustrates the insertion of the end of the film, which is placed on the core and pushed under one side of the pivoted member 82, as shown in Fig. 28. Upon rotation of the reel 79 the end of the film 7 is clamped by the element 82 against one of the walls 81 as shown in Fig. 29.

Referring to Fig. 27 it will be noted that the end of the film 7, when applied to the core 78 of the reel, forms an angle α with respect to a tangent. The reel 79 is now rotated in the direction of the arrow 84, and without any additional means or manipulation the end of the film 7 slides into the recess 80 and in the space between the adjacent wall 81 and the pivoted member 82. When the reel 79 is rotated farther, as shown in Fig. 29, the film is partially wrapped around the member 82 and rotates the latter anti-clockwise about its pivot axis 85, thereby clamping the end of the film in the recess against the adjacent wall 81. This last described embodiment has the advantage that the film may be attached to the core of the reel or spool without stopping the rotation of the same, or without removing the reel from the supporting spindle in the projector or the like. Another advantage is that even when the reel or spool is not rotated the film may be automatically inserted and clamped in position, as long as a relative movement between the core and the end of the film takes place and is produced by the operator. The pivoted elliptical core member 82, owing to its symmetric shape and mounting is relatively simple and may be made rather small in size without losing its effectiveness.

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REELS OR SPOOLS FOR MOTION PICTURE FILMS

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4 Sheets-Sheet 1

Fig. 1

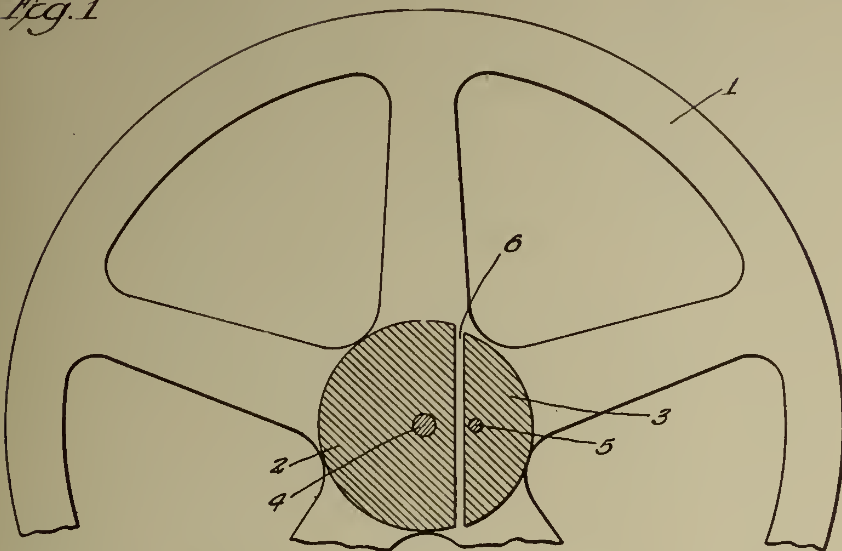


Fig. 2

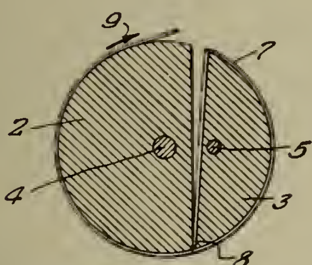


Fig. 3

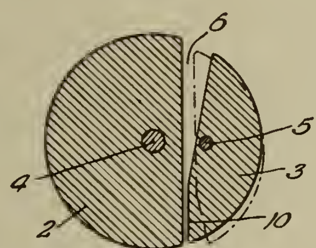


Fig. 4

Fig. 5

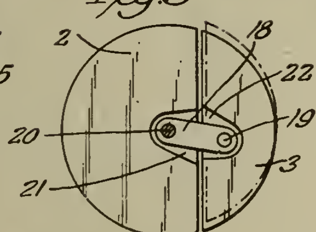


Fig. 6

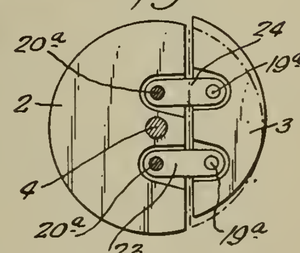


Fig. 7

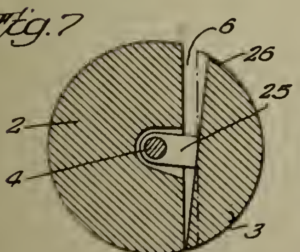
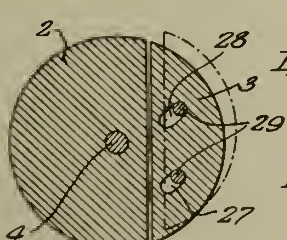


Fig. 8



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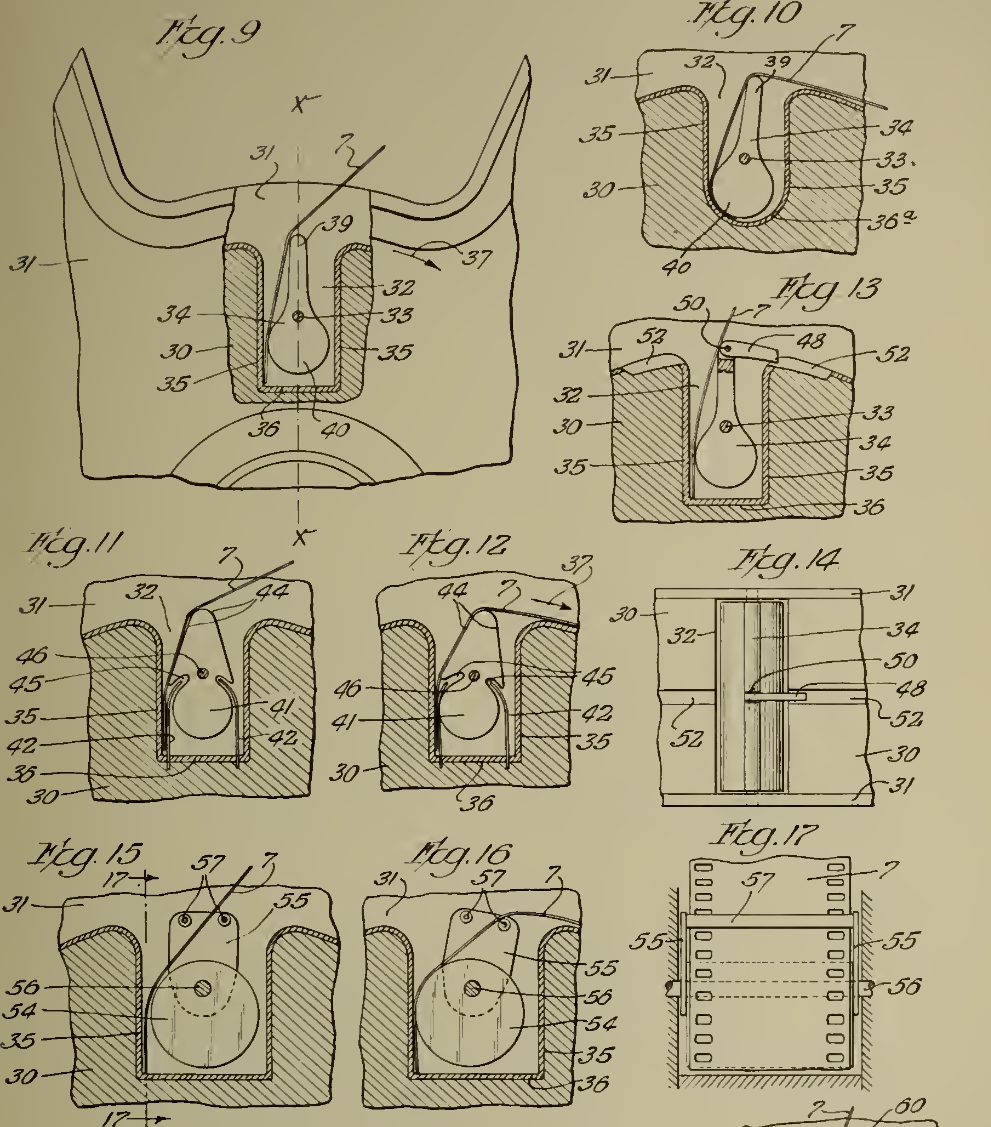
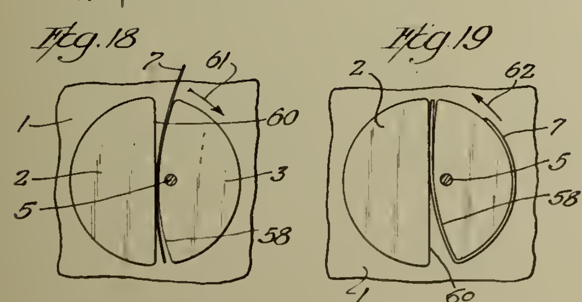
BY A. P. C.	Filed Aug. 4, 1941	4 Sheets-Sheet 2





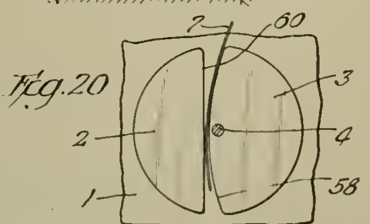


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Fig. 21

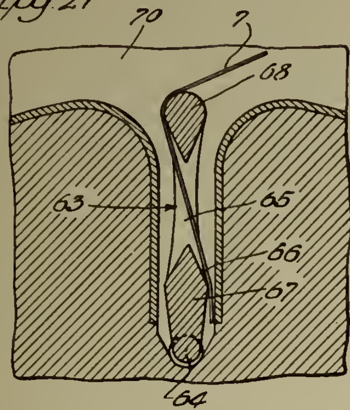


Fig. 22

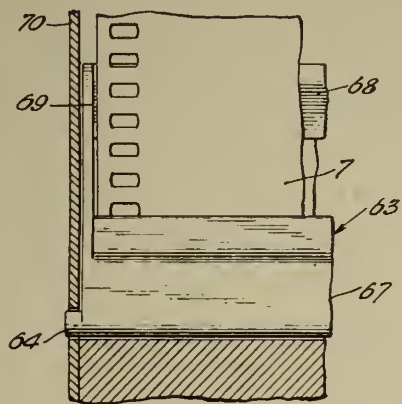


Fig. 23

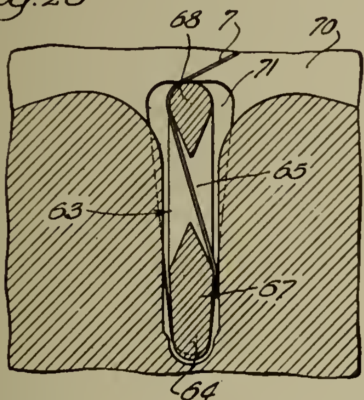


Fig. 24

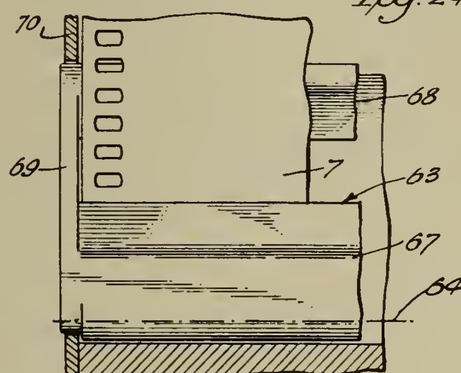


Fig. 25

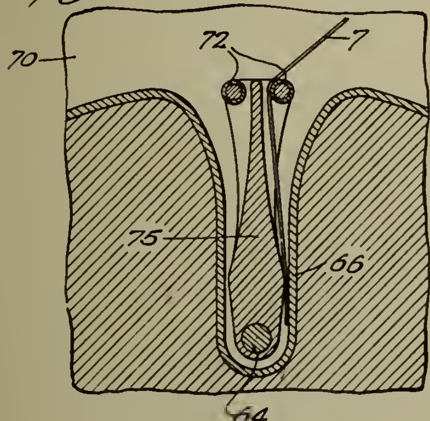
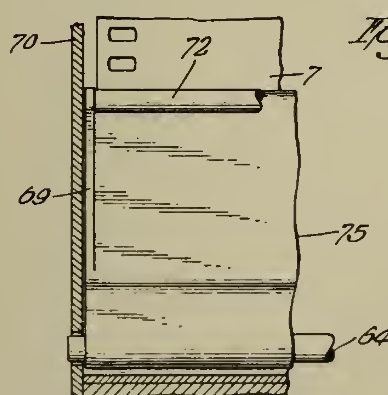


Fig. 26



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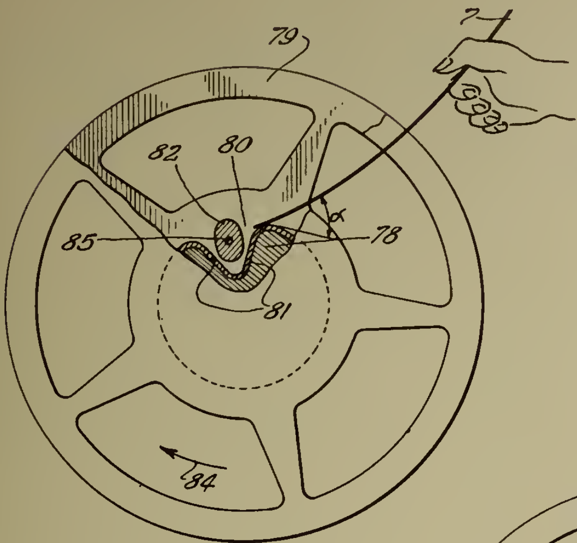

Fig. 27

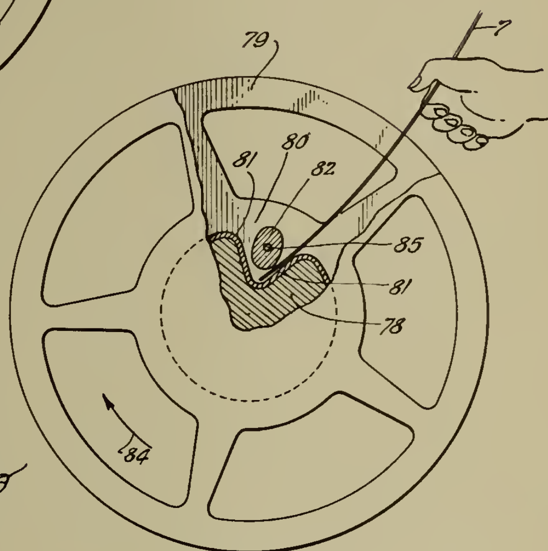

Fig. 28

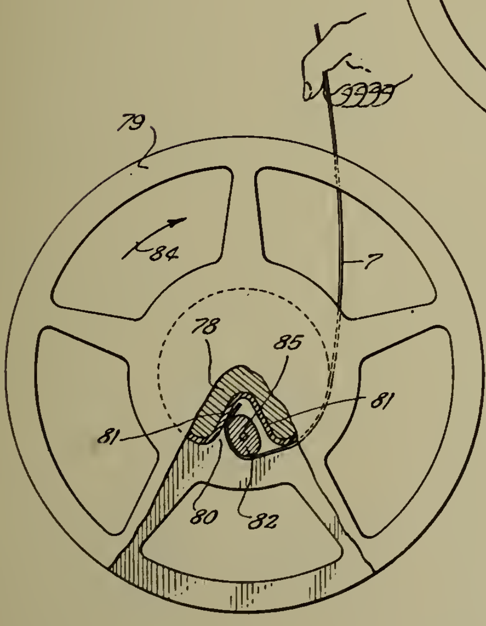

Fig. 29

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ALIEN PROPERTY CUSTODIAN

RIVETED JOINTS

Jean Emile François Gobin (dit Daudé), Neuilly-sur-Seine, France; vested in the Alien Property Custodian

Application filed August 8, 1941

My invention relates to riveted joints and more particularly to those in which the plates or other parts to be riveted together are accessible only from one side of the joint.

The chief object of my invention is to provide a riveting system for such a joint which is better adapted to meet the requirements of practice than those used for the same purpose up to the present time.

According to a feature of my invention, I reinforce a hollow rivet by fitting a cap or the like on the free end of the rivet shank behind the rear face of the joint and at a distance from said rear face so as to leave a non-reinforced portion of the rivet shank between said cap and said rear face, which portion is subsequently compressed by means of a pulling member preferably introduced into the shank from the front end thereof and adapted to act on said reinforcing element or cap, the compressed portion thus forming a flange bearing against the rear face of the joint.

According to another feature of my invention, I make use, for performing the operation above described of a riveting tool including a pulling member having a flat head located in an axial plane so that it can be inserted in an elongated slot provided in the reinforcing cap and relatively rotated so as to bear against said cap and to permit of pulling it for compression of the rivet shank.

Other features of the present invention will result from the following detailed description of specific embodiments thereof.

A preferred embodiment of the invention will be hereinafter described, with reference to the accompanying drawings, given merely by way of example, and in which:

Fig. 1 is an axial section of a hollow rivet made according to the invention, the left hand side of this view showing the rivet before the riveting operation and the right hand side after this operation has been performed;

Fig. 2 is a view similar to Fig. 1, showing a modification;

Fig. 3 is a plan view of a rivet according to the invention, after fixation thereof and while the riveting tool is being disengaged;

Fig. 4 is a partial elevational view of the head of the pulling member of the riveting tool;

Fig. 5 is a sectional view of the riveting tool, on the line V—V of Fig. 6;

Fig. 6 is a sectional view corresponding to Fig. 5, on the line VI—VI thereof.

As shown by Figs. 1 and 2, the rivet according to my invention includes a hollow frusto-conical part 1, provided with a flange 2 at its larger end so as to bear against the front face of the joint and with a reinforcing cap 3 at the other end. Preferably, part 1 is made of gradually decreasing thickness from end 2 toward the other end.

The height of cap 3 is so chosen, relatively to the length of shank 1 and to the thickness of the plates 5 to be assembled together to form the riveted joint, that when the rivet is engaged in the hole 4 of said plates, with flange 2 applied against the front face of the joint, a non-reinforced portion 6 is left between the front edge of cap 3 and the rear face of the joint. The height of this portion 6 must be sufficient for supplying the metal necessary for forming by deformation the flange 7 to be finally obtained on the rear face of the joint (right hand side of Fig. 1 or Fig. 2).

Furthermore, the apex angle of the cone formed by shank 1 is so chosen that cap 3 can pass through hole 4 when the rivet is being inserted in position.

In order to fix the rivet, cap 3 must be forcibly pulled toward the front while flange 2 is kept applied against the front face of the joint. It compresses portion 6, which yields and flattens outwardly so as to form flange 7. The end of shank 1 which is inserted in cap 3 is prevented from expanding by the presence of said cap. As for the portion of said shank within hole 4, its expansion is limited by the wall of said hole, against which it is closely applied. Furthermore, as said portion of the shank is of greater thickness, it is less liable to deform, and anyway I may give increased rigidity to this portion of the rivet shank.

Cap 3 may be removed after the riveting operation.

In the modification illustrated by Fig. 2, the rounded end of cap 3 forms an annular enlarged portion so that, when the rivet is compressed, the end of shank 1, brought into contact with the cap bottom expands in said enlarged portion against the inner wall of which it is applied, so that cap 3 and shank 1 are secured together.

It should be noted that the rivet proper, i. e. shank 1, with its flange 2, is a standard tubular piece, so that the only element to be specially manufactured for carrying out the invention is cap 3.

The axial compression which serves to fix the rivet in position is performed in any suitable manner. When only one side of the riveted joint is accessible, it is advantageous to proceed in the following manner:

Cap 3 is provided with an elongated aperture

8 in its bottom, the length of said aperture or slot being substantially equal to the inner diameter of shank 1 at its smaller open end 9.

The riveting tool includes a pulling member 10 (Fig. 4) consisting of a steel wire 10 the end of which is bent so as to form a loop 11 the outer diameter of which is just a little smaller than the length of slot 8. The inside of the loop is filled with solder or the like so as to form a solid flat circular head adapted to pass through the head 9 of shank 1 and the slot 8 of cap 3.

Rod 10 is mounted in a hollow circular body 14 (Figs. 5 and 6) in which it can both slide in the direction of its axis and rotate about said axis. This body 14 includes, at its upper end, a part 12 adapted to support the rivet during the riveting operation and fitted with a nose 12^1 (for instead screwed thereon) having a conical end and a cylindrical part adapted to be forced into the rivet shank at the beginning of the riveting operation. A sliding member 15 is mounted inside body 14 and it is urged toward part 12 by a spring 16. This member 15 carries a transverse pin 17 through which rod 10 extends, two abutments 22 and 23 carried by said rod bearing on the cylindrical wall of said pin on either side thereof. Thus, as far as longitudinal sliding movements are concerned, inside body 14, member 15 and rcd 10 move together.

Body 14 carries a pivot 19 about which can rotate an operating lever 20 movable in radial slots 14*a* and 15*a* of body 14 and sliding member 15 respectively. The edges 20*a* of this lever bear against pin 17. Thus, when lever 20 is pivoted in the direction of arrow 21 (Fig. 5), it causes pivot 19 (together with body 14 on which it is mounted) and pin 17 (together with sliding member 15 and rod 10, with which it is connected) to move in opposite directions (the first upwardly and the second downwardly) with respect to each other, against the action of spring 16.

Rod 10 extends through the bottom 24 of body 14 and it is provided, at its lower end, with a handle 25 for rotating said rod about its axis, this rotation being limited by at least one abutment pin 25*a*.

Part 12 carries, slidably mounted thereon, an annular part 26, urged upwardly by a spring 27 interposed between parts 12 and 26, the longitudinal movement of part 26 with respect to part 12 being limited by a pin 28 carried by part 26 and engaging in a longitudinal slot 29 of part 12.

This device works in the following manner:

The rivet is first fitted on the riveting tool as follows: The flange 2 of said rivet is pressed against the edge of part 26 so as to force the latter downwardly on part 12 against the action of spring 27, care being taken that the slot 8 of cap 3 is in line with the head 11 of rod 10, so that said head can pass upwardly through said slot. When said head 11 projects fully above cap 3, handle 25 is turned through 90° and the axial thrust exerted on the rivet is released. Thus, under the effect of spring 27, head 11 is tightly applied in a hollow 13 provided on the external wall of cap 3 at right angles to slot 8. The rivet is now held at the end of the riveting tool.

The rivet is then inserted in the holes 4 of plates 5 so that its flange 2 is applied against the front face thereof.

Lever 20 is now pivoted in the direction of arrow 21. As a consequence of this movement, nose 12^1 is first forced into shank 1 until the shoulder 12^2 of part 12 comes to bear against flange 2 of the rivet and the portion of shank 1 located inside holes 4 is expanded against the wall of said holes until said portion of the shank is made substantially cylindrical. Then cap 3 is pulled downwardly by rod 10 through the head 11 thereof, thus deforming the portion 6 of the shank (Fig. 2) so as to crush it into the form of a flange 7, where the rivet is set.

It then suffices to release lever 20, to turn back handle 25 through 90° and to remove the riveting tool from the rivet, by passage of head 11 through slot 8.

In a general manner, while I have, in the above description, disclosed what I deem to be practical and efficient embodiments of the present invention, it should be well understood that I do not wish to be limited thereto as there might be changes made in the arrangement, disposition and form of the parts without departing from the principle of the present invention.

JEAN EMILE FRANÇOIS GOBIN DIT DAUDÉ.

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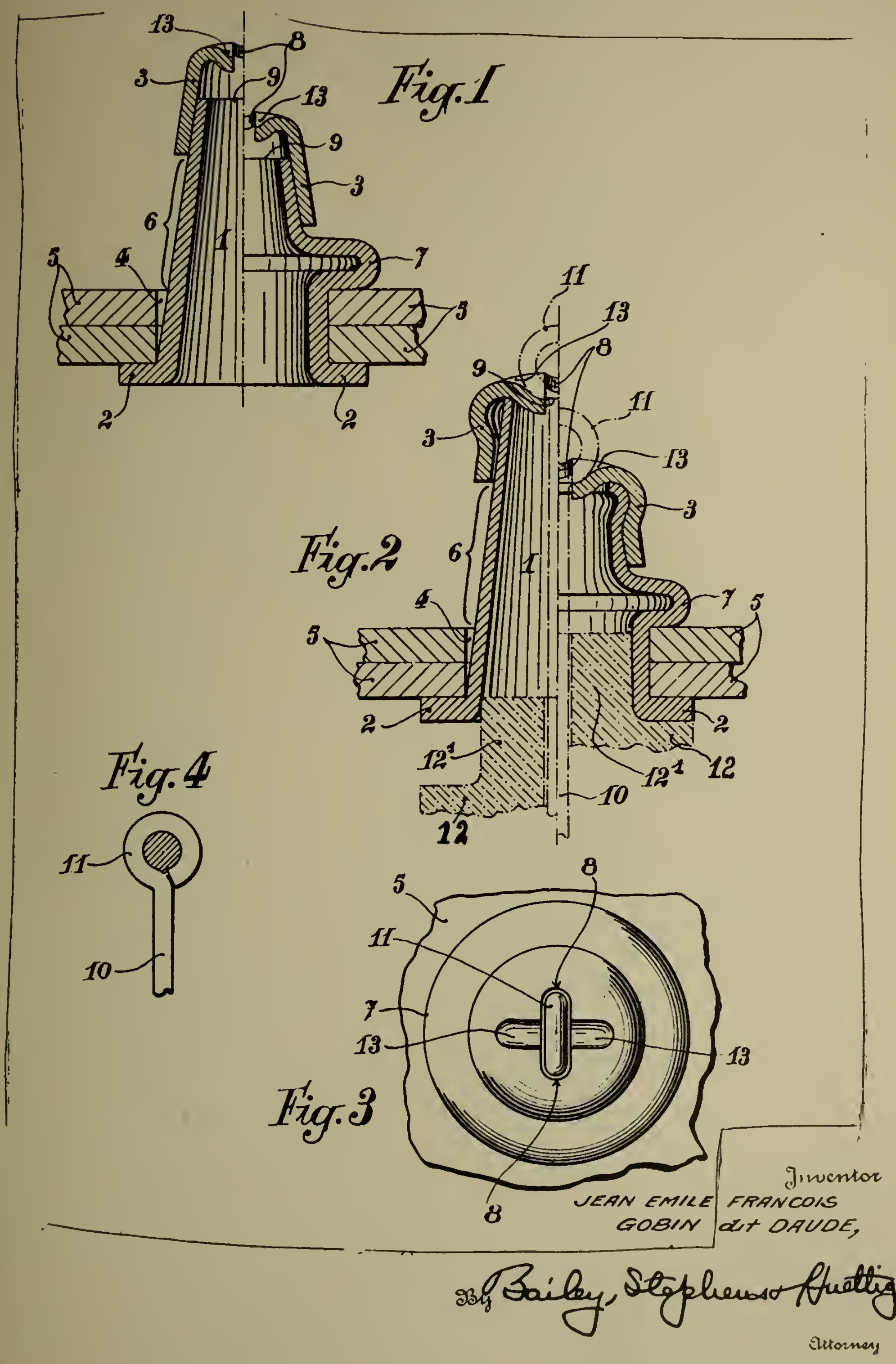

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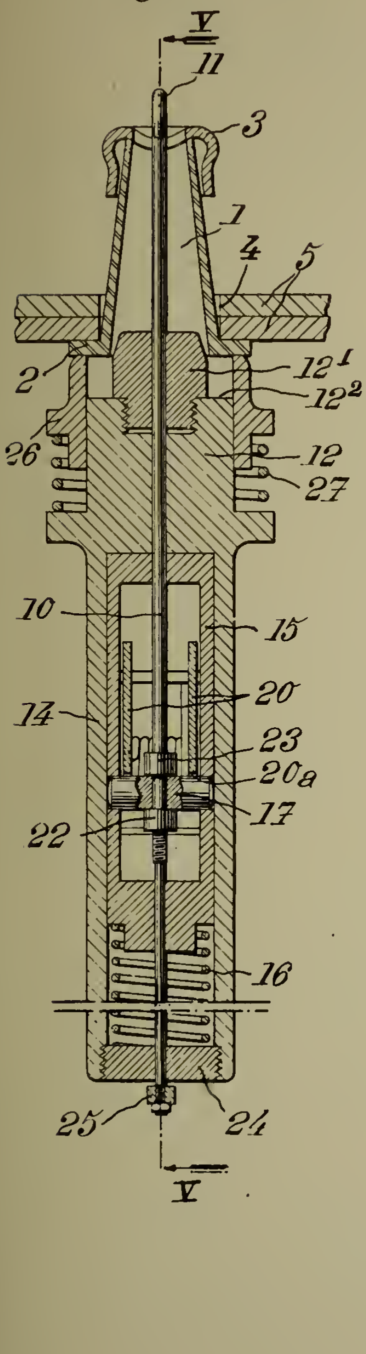

Fig. 6

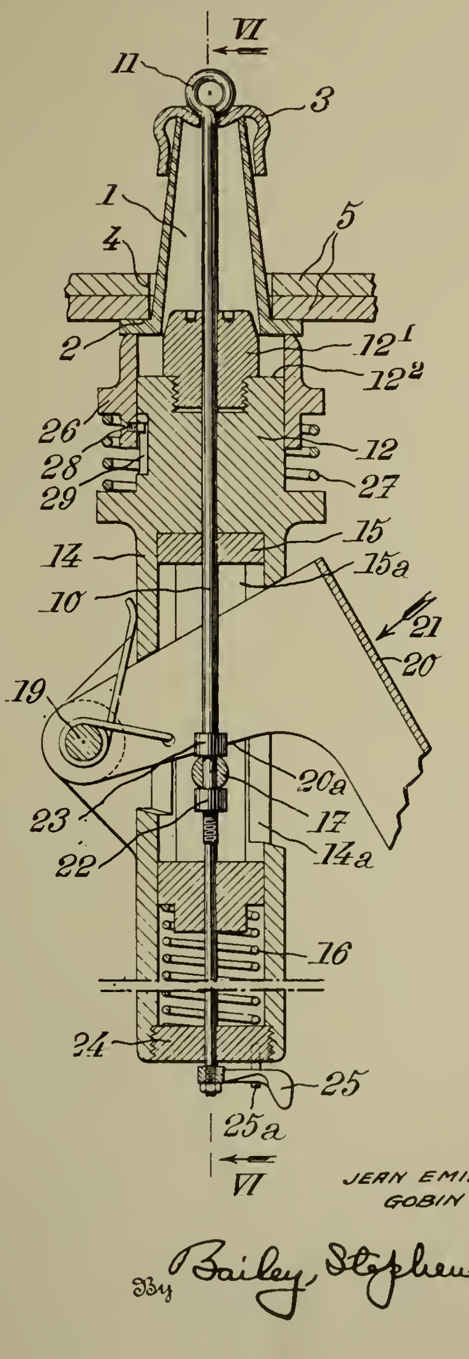

Fig. 5

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ALIEN PROPERTY CUSTODIAN

RIVETED JOINTS

Jean Emile François Gobin (dit Daudé), Neuilly-sur-Seine, France; vested in the Alien Property Custodian

Application filed August 8, 1941

The present invention relates to riveted joints and more especially to those in which it is not possible to have access to one of the sides of the joint for riveting purposes.

The object of the present invention is to provide a riveting system which is better adapted to meet the requirements of practice than those used for the same purpose up to this time.

It has already been suggested, in the case of a riveted joint of the type above referred to, to make use of a hollow or tubular rivet provided, at one end (the outer or accessible end) with a flange adapted to bear against the corresponding face of the joint, and, at the other end (inner end located on the side of the joint which is not accessible) with anchoring means adapted to cooperate temporarily with a pulling tool engaged in the hollow rivet. Such a rivet was introduced, from the outer side (or front side) of the joint, into the holes provided in the parts of the joint, after which it was subjected, through any suitable means, to a combined compression exerted on the outer end and traction exerted on the inner end. The rivet was thus axially compressed and deformed so as to form a flange-like annular bulge against the rear face of the joint. The pulling member was then removed and the operation was finished.

According to an essential feature of the present invention, I provide a hollow rivet the inner end of which forms at least one inward projection adapted to cooperate with a corresponding portion of the pulling element of the riveting tool, said portion being adapted, in a relative position thereof, to be introduced through the hollow of the rivet past the restricted orifice left by the inward projection thereof, and, in another relative position, to bear against said projection so as to enable the pulling element of the riveting tool to crush the rivet in such manner as to form the desired annular bulge against the rear face of the joint.

According to another feature of the present invention, the riveting tool includes a mandrel adapted to fill with a slight play at least a part of the portion of the rivet that is to be deformed under the effect of the axial compression thereof, so as to avoid an inward deformation of this portion.

Other features of the present invention will result from the following detailed description of some specific embodiments thereof.

Preferred embodiments of the present invention will be hereinafter described, with reference to the accompanying drawings, given merely by way of example, and in which:

Fig. 1 is a large scale axial section of a rivet, together with the riveting tool inserted therein, the whole being made according to a first embodiment of the invention;

Fig. 2 is a view, similar to Fig. 1, showing the parts in a position corresponding to a further step of the operation;

Fig. 3 is a section on the line III—III of Fig. 1;

Fig. 4 is a sectional view of the rivet, after fixation thereof;

Figs. 5, 6 and 7 are three sectional views illustrating three successive steps of the manufacture of a rivet of the kind shown by Figs. 1 and 2;

Fig. 8 is a view similar to Fig. 1, showing a riveting system made according to a second embodiment of the invention;

Fig. 9 is a partial view of the system of Fig. 8, showing another step of the riveting operation, to wit the end of this operation;

Fig. 10 is a sectional view on the line X—X of Fig. 8;

Fig. 11 shows, on an enlarged scale, the upper portion of Fig. 8;

Fig. 12 is a sectional view on the line XII—XII of Fig. 11;

Fig. 13 is a partial section on the line XIII—XIII of Fig. 11.

The rivet **1** used according to the invention is a blind tubular member, of general cylindrical or slightly conical shape. In the following description, it will be supposed that it is cylindrical, as shown by the drawings.

This member **1** is provided, at its outer (or front) end with a flange **2** through which the rivet bears against the front face of the joint.

Near its inner (or rear) end, member **1** is provided with an inward projection obtained by deformation of the metal thereof.

According to an embodiment of the invention (illustrated by Figs. 1 to 7), this inward projection forms an annular inner ridge **3**. Advantageously, the portion **4** of this ridge which faces the inner end of the rivet is a frusto-conical surface of large apex angle (170° for instance) having its smaller base closer to the inner end of the rivet than its larger base.

This ridge **3** is positioned on the rivet shank at such a distance from the inner end thereof that a blind space **5** of a height approximating the diameter of said rivet is formed beyond said ridge.

The riveting tool to be used with a rivet of this kind includes the following chief elements:

a. A supporting element for the rivet, having

for instance the shape of a finger on which the rivet can be slipped;

b. An abutment **6** for flange **2**;

c. A pulling member including an expanding head with gripping means **7**, this head being capable, in the retracted position of said means **7**, of passing through the aperture left by projection **3**;

d. Means for causing said head to expand so that means **7** come into engagement with surface **4**; and

e. Means for causing the expanding head and abutment **6** to move toward each other, so as to obtain the axial compression of the shank and the formation of flange **8** (Fig. 4).

Of course, the specific construction of this riveting tool, the chief characteristic of which is the provision of the expanding head thereof, with its gripping means and the means for expanding and retracting said gripping means, may correspond to many different embodiments.

The particular embodiment illustrated by Figs. 1 and 2 includes the following parts:

a. A stirrup **10** slidable in a body **9** and integral with a finger **11** adapted to act as an inner support for the rivet;

b. Two small levers **12** pivoted to the free end of this finger **11** and each provided, at its end, with a hook **7**;

c. A pulling rod **13** slidable axially in said finger **11** and provided, at its upper end, with a cam **14** capable, by coacting with parts **12** and **12′**, of expanding or retracting hooks **7** according as rod **13** is being pulled or, on the contrary, pushed, respectively; and

d. A lever **16**, pivoted about a spindle **15** carried by body **9**, and adapted, when pivoted downwardly, first to pull rod **13** downwardly, so as to expand hooks **7**, previously introduced into chamber **5**, and then to pull stirrup **10** downwardly, so as to compress the rivet shank and to form flange **8**.

For this purpose, inclined edges **17**, carried by lever **16**, are adapted first to push, against the action of a spring **18**, small rollers **19** mounted on a spindle **20** rigid with rod **13** and the ends of which are engaged in slots **21** provided in the wall of stirrup **10** (Figs. 1 to 3), so as to move said rollers downwardly. Of course, these slots are made of such a length that the relative displacement of rod **13** with respect to stirrup **10** is stopped when hooks **7** are moved apart the desired distance.

It will be readily understood that, once the play provided by slots **21** has been caught up, the movement of spindle **20** causes stirrup **10** to be displaced downwardly against the action of spring **22**.

The displacement of lever **16** in the opposed direction causes, after the riveting operation has been performed, stirrup **10**, and therefore hooks **7**, to be moved upwardly, and said hooks to be brought close to each other into the relative position illustrated by Fig. 1, after which finger **11** can be removed from the inside of the rivet.

Of course, the rivets to be utilised for carrying out the invention as just above explained may be made in any suitable manner. However, I have found that it is advantageous to have recourse to the method illustrated by Figs. 5 to 7 inclusive.

According to this method, I start from a stamped blank the inner end of which is preferably semi-spherical (Fig. 5).

The shank is then deformed, at the proper level, so as to form an inward projection **3**[1] of the shape shown by Fig. 6, which includes no undercut portion for the shaping tool.

I then introduced into the shank thus shaped a mandrel **23** of a diameter corresponding to that of said shank and capable of supporting the lower portion of inner ridge **3**[1], as shown by Fig. 6.

Finally, I exert an axial thrust on the upper end of the shank by means of a concave punch **24**, while mandrel **23** is maintained in position. Under the effect of this thrust, the lower portion of inner ridge **3**[1], which is supported by mandrel **23**, keeps its initial shape, but the upper portion of said ridge is deformed and given the inclination above described which is to be obtained for surface **4** (Fig. 7).

Of course, if necessary, I provide means for preventing deformation of said lower portion of ridge **3**[1] when punch **24** is acting on the rivet shank, said means consisting, for instance, of an abutment **23′** rigid with mandrel **23** and against which the flange **2** of the rivet comes to bear.

I will now describe a second embodiment of my invention illustrated by Figs. 8 to 13.

In this case, I give the metal shank, otherwise made as above described, instead of the inner annular ridge **3**, at least one inward projection extending over only a portion of the periphery of said shank.

The riveting tool is provided with a head carrying, preferably in a fixed manner, at least one outward projection capable of passing, when suitably positioned, through the restricted orifice left free by the inward projection of the shank. After it has thus been inserted past the inward projection of the shank, the outward projection of the tool can be brought, by suitably turning said tool about the axis of the shank, into a position such that these two projections engage each other when the tool is being pulled backward.

In the example illustrated by Figs. 8 to 13 inclusive, the elements above mentioned are made as follows:

The rivet shank includes two inward projections 3^0 and 3^{00}, diametrally opposed and symmetrical (Fig. 12), these projections extending each (in section by a plane at right angles to the axis of the rivet shank) over an angle A smaller than 180° and for instance equal to 90°.

Advantageously, these projections are given the shape clearly shown by Figs. 11 to 13, that is to say, in particular, a shape complying with the following conditions:

a. In section by the bi-sector plane of angle A (that is to say as shown by Fig. 11), the mean inclination B of that of the faces of the inward projection which faces the inner end of the rivet is relatively small, say 10°, while the mean inclination C of the other face of the inward projection may be much greater, in order to facilitate stamping; and

b. At least some of the sections of the projection of the shank by planes parallel to the axis of the rivet and perpendicular to the bi-sector plane of angle A (such for instance as the section shown by Fig. 13) show, for the face of said inward projection which faces the inner end of the rivet, a convexity turned toward said inner end.

As for the riveting tool, it includes the following essential elements:

a. An element for supporting the rivet, this element consisting for instance of finger on which the rivet can be slipped;

b. An abutment **6** for flange **2**;

c. Pulling means including a head provided

with two opposed outward projections 25⁰ and 25⁰⁰ complying with the conditions above set forth and the active faces of which (adapted to come into contact with inward projections 3⁰ and 3⁰⁰ for exerting thereon the necessary thrust) have a concavity (Fig. 13) corresponding to the convexity of the corresponding faces of said inward projections; and

d. Means for exerting on said pulling means the effort necessary for deforming the rivet shank so as to form a flange thereon.

In the particular embodiment illustrated by Figs. 8 and 9, the rivet supporting member consists of a finger **26** adapted to slide in a body **9**, this finger being provided with a shoulder or abutment **27** adapted to slide in an enlarged portion of said body **9**.

The means for exerting the necessary pull consists of a rod **28** adapted to slide axially in finger **26**, this rod including a head, projecting from the free end of finger **26** and provided with the outward projections **25⁰** and **25⁰⁰**. Rod **23** is further provided with a collar **29**, slidable inside body **9**.

A spring **30** is interposed between this collar **29** and a partition *9a* within body **9**, so as to push rod **28** upwardly.

Another spring, to wit **31**, is interposed between collar **29** and abutment **27**.

I provide, at the lower end of rod **28**, means for turning said rod about its axis, such means consisting, for instance, of a rotatable handle **32** provided with a socket **33** of square-shaped inner section in which the square end of rod **28** can slide.

Finally, a lever **34** is pivoted to body **9** and adapted to impart the necessary axial displacements to rod **28**.

With such a tool, it will readily be understood that, at rest, spring **30** pushes upwardly the free end of rod **28** and also, through spring **31**, the free end of finger **26**.

The rivet to be fitted can then be mounted on the riveting tool in the position shown by Figs. 8 and 11.

When, after having inserted said rivet in the holes of the plates to be assembled together by riveting, rod **28** is pulled downwardly by means of lever **34**, the rivet shank is crushed against the rear face of the inner plate, as a consequence of the thrust transmitted to the inward projections **3⁰** and **3⁰⁰** of the rivet shank by the outward projections **25⁰** and **25⁰⁰** of the head of rod **28**.

After the riveting has thus been performed, it suffices, after having released lever **34**, to turn handle **32** through 90° for bringing the respective projections of rod **28** and rivet **1** out of engagement with one another. The riveting tool can then be slipped out from the rivet.

The preceding description makes it unnecessary to enter into further explanations concerning the operation and advantages of the riveting system according to the invention.

According to still another feature of the invention, which may be used separately, the riveting tool is provided with a mandrel capable of filling with a slight play at least a part of the portion of the inside of the rivet which corresponds to the zone in which said rivet is liable to deform under the effect of the axial thrust to which it is subjected.

For instance, in the case of the riveting tool illustrated by Figs. 8 and 9, finger **26** is made of such shape that it fills substantially the whole of the inside of the rivet, from the outer end thereof to the level of the maximum depth of the inward projections **3⁰**, **3⁰⁰** thereof.

Thus, the end of finger **26** is made of a shape corresponding to the axial section shown by Fig. 11 and the cross section shown by Fig. 12 (line **0** of this last mentioned Fig.), whereby said finger supports the portions of the wall of the rivet located between the inward projections **3⁰** and **3⁰⁰** thereof and prevents said portions from being moved toward each other under the effect of the axial thrust exerted on said projections **3⁰** and **3⁰⁰** and which tends of course, to force these projections away from each other.

With such an arrangement of finger **26**, it is advantageous to place collar **29** in a position such that, at rest, projections **25⁰** and **25⁰⁰** are very close to the terminal edge of finger **26** but can be moved away therefrom, against the action of spring **31**, to such a distance that, once the rivet has been fully engaged on finger **26**, it is possible, by turning handle **32** while the rivet is kept in position, to cause projections **25⁰** and **25⁰⁰** to slip over projections **3⁰** and **3⁰⁰** and into engagement therewith.

When rod **28** is being pulled downwardly, finger **26** practically follows the movement of said rod and its presence inside the rivet prevents any deformation thereof toward the inside and ensures the satisfactory formation of the fixation flange resulting from the deformation of the metal shank **1**.

Of course, the above features are not limitative and for instance the bearing faces of inward projections **3⁰** and **3⁰⁰** might be concave instead of convex as shown by Fig. 13, while the corresponding faces of outward projections **25⁰** and **25⁰⁰** would be convex instead of concave as shown by the same Fig.

In a general manner, while I have, in the above description, disclosed what I deem to be practical and efficient embodiments of the present invention, it should be well understood that I do not wish to be limited thereto as there might be changes made in the arrangement, disposition and form of the parts without departing from the principle of the present invention.

JEAN EMILE FRANÇOIS GOBIN DIT DAUDÉ.

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Fig.1

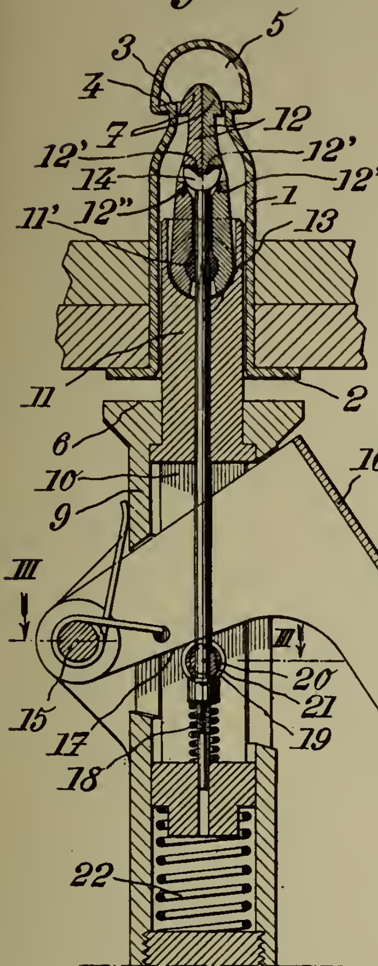

Fig.2

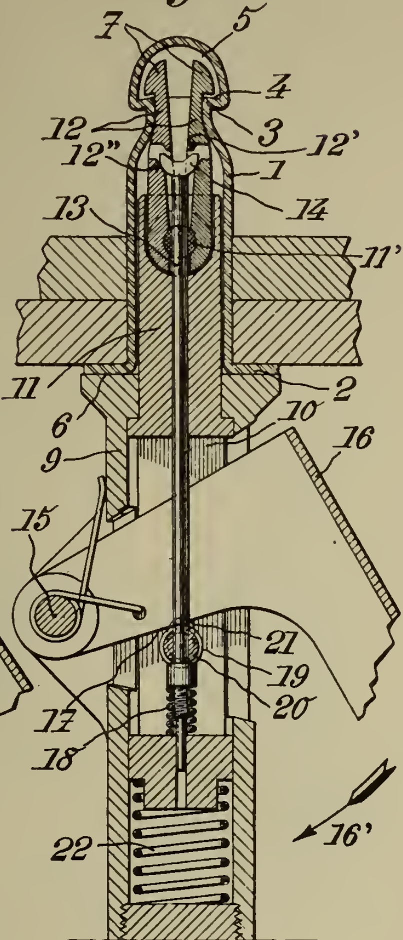

Fig.3

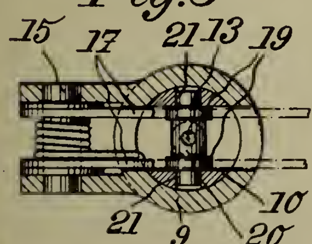

Fig.4

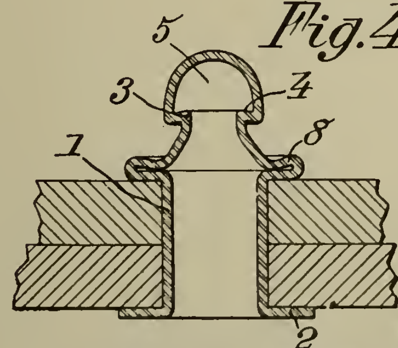

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Fig. 5

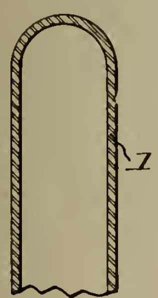


Fig. 6

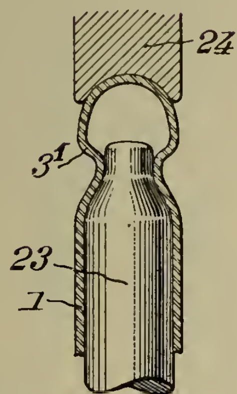
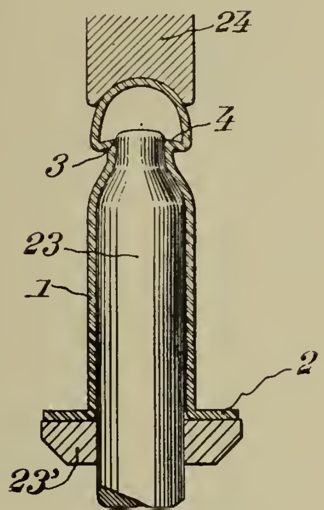


Fig. 7



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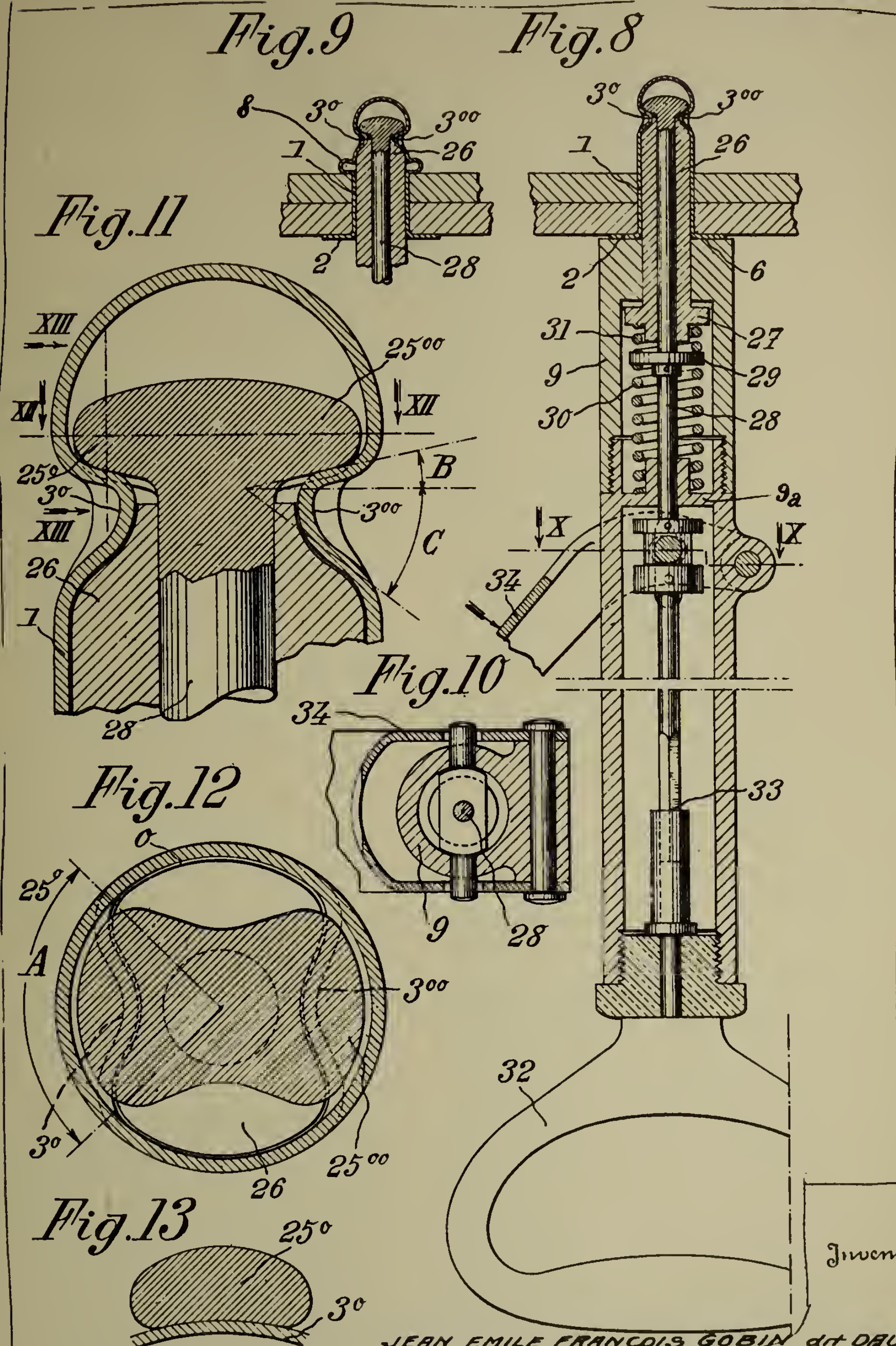
RIVETED JOINTS

Filed Aug. 8, 1941

Serial No. 406,072

3 Sheets-Sheet 3



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ALIEN PROPERTY CUSTODIAN

METHOD FOR PRODUCING A CONTROL SHEET, ETC.

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Application filed August 12, 1941

The invention relates to a method for producing a control sheet as a means for controlling entries made according to the Staffel-method, an apparatus and an entering sheet for use in carrying out said method.

It has for its object to obtain a control of entries made on charts or the like in accordance with the Staffel-method. The invention is based on the insight that by adequate combination of the Staffel-method with the socalled tabular method a control can be obtained which is very satisfactory for the bookkeeping practice. According to the Staffel-method underneath the last entered debit or credit amount (old count) always follows the mutation which said amount is to be subjected to, whereafter by addition of the amounts appearing in Staffel-form on the entering or account sheets the new count is determined. This addition may give rise to mistakes and the purpose of the invention is to enable one to detect those mistakes in a simple manner.

According to the invention the method consists in this that an entering sheet is filled up according to the Staffel-method and that simultaneously therewith on a control sheet lying under that entering sheet prior to or after relative displacement of both sheets the corresponding entries in tabular form are transferred by means of the copying method, in which the old count of the entering sheet is by tracing copied on the control sheet. On this control sheet therefore the amounts which on the account sheet appear in Staffel-form below each other as old count, mutation and sum of both (new count) appear in tabular form adjacent one another and not below one another. This appearing on the control sheet adjacent one another of old count, mutation and new count obtained by mutation produces for a number of account sheets and the entries made thereon columns on the control sheet located adjacent one another the similar amounts of which columns are added.

Consequently totals of new counts, old counts and mutations are obtained in which the total of the new counts should correspond to the sum of the totals of old counts and mutations. If this correspondence is lacking then in the carrying out of the Staffel-method on the entering or account sheets there must have been made somewhere an adding mistake. This mistake may be detected on the control sheet by perusing in which row of adjacent entries appearing thereon of a new count, old count and mutation the amount of the new count is not equal to the sum of the amounts of old count and mutation, whereafter the entering sheet concerned may be detected and controlled.

Since in the method according to the invention the old count of the entering sheet is transferred to the control sheet by tracing, i. e. not by writing it down separately, a source for eventual mistakes is thereby eliminated, for tracing practically excludes the producing of a faulty numeral.

Thus there is obtained a controlled Staffel-method based on an efficacious combination of the Staffel and the tabular method carried out simultaneously on entering and control sheet.

Since in the entering method according to the invention items appearing below one another on the entering sheet must appear adjacent one another on the control sheet and since as stated above a relative displacement of entering sheet and control sheet is necessary to this end, and since this relative displacement is always essentially the same for each series of entering operations accruing from a mutation in a count it is to be preferred to make use of an apparatus in which according to the invention the displacements are positively guided so that any feeling and seeking after the correct adjustment of the entering sheet to be displaced with respect to the control sheet is avoided.

To this end over an underlayer for a control sheet and eventually a carbon sheet, which sheets may be secured thereto by clamps, a carriage may be shiftable, said carriage being adapted to clamp thereto an entering sheet and being provided with a line-indicator shiftable with respect to the entering sheet. According to the invention the carriage when being shifted may be compelled to follow a path such that when entering in accordance with the method referred to above the entries at the places on the entering sheet determined by the line-indicator the amounts appearing on the entering sheet below one another in accordance with the Staffel-method will appear in tabular form adjacent one another on the control sheet. This implies that the carriage, during its shifting necessary for the relative displacement of entering sheet and control sheet in accordance with the novel method, is positively guided.

With a view to the different levels on which in the Staffel-method the entries are made on the entering sheet and with the even level on which the entries are made in tabular form on the control sheet the positive guiding according to the invention may take place along a zigzag-shaped line or path so that the carriage, when

normally used, is arrested at least in the turning points of said line or path. A zigzag line constitutes the shortest connection between a higher and a next lower entering place and between a lower and a next higher entering place respectively.

The beginning and the end point of the line elements constituting the zigzag path constitute arresting points for the carriage in such a manner that a predetermined preferably small resistance against shifting is to be overcome in order to remove the carriage from such an arresting point and move it to a following point.

The original position of the carriage may be maintained during shifting e. g. by the use of a pair of mutually parallel guide paths in which two corresponding guide members or groups of guide members with which the carriage is provided are movable.

When using a zigzag path for the carriage then in the hand writing entering method when starting from a neutral or central position for the carriage and displacing the carriage from this position for entries in the debit to the left and in the credit to the right the zigzag path at the left and at the right of said neutral position may consist of a downwardly inclined portion followed by an upwardly inclined portion for the reason that the mutation will be entered on the entering sheet underneath the old count. Therefore, if the mutation has been entered on the entering sheet a downwardly inclined displacement of the ruler will follow, whereupon the old count appearing on the entering sheet is traced and will appear on the same line of the control sheet adjacent the mutation.

The making of mistakes during this tracing is practically excluded. Further, since on the entering sheet the total of old count and mutation appears as a new count underneath the mutation a correspondingly upwardly increased inclined displacement of the carriage is necessary in order to get the new count adjacent the old count on the control sheet. The zigzag path of the carriage has then been run through.

The carriage may be a vertical ruler and the line-indicator may be a horizontal ruler slidable along the vertical ruler in vertical direction. This horizontal ruler may have such a length that when the vertical ruler occupies the neutral position the horizontal ruler spans or overlaps also the credit side of the entering and the control sheet.

The invention will be more fully understood with reference to the accompanying drawings illustrating it by way of examples.

Fig. 1 is a plan view, partially broken away, of an apparatus according to the invention for carrying out the method according to the invention when the manual writing method is applied.

Fig. 2 is on a larger scale a section on the line II—II in Fig. 1.

Fig. 3 is on the same scale as Fig. 2 a section on the line III—III in Fig. 1.

Figs. 4–8 are plan views of the apparatus in which the carriage with line-indicator and an entering sheet clamped to the carriage are shown in different positions with respect to the control sheet; Fig. 6 shows the carriage in a neutral or central position whereas Figs. 5 and 4 show successive positions located at the left of the neutral position and occurring when entering in the debit, and Figs. 7 and 8 successive positions located at the right of the neutral position and occurring when entering in the credit.

Fig. 9 is a plan view of a partially broken away control sheet with entries made thereon according to the tabular method by means of the apparatus according to Figures 1–3.

Figure 10 is a plan view of an entering sheet with entries made thereon according to the Staffel-method simultaneously with the entries referred to above.

The apparatus according to Figures 1–3 will first be described and then it will be described with reference to Figures 4–10 in what manner the apparatus is used.

In Figs. 1–3 1 is an underlayer or table upon which a control sheet may be laid. To this table at the left in Fig. 1 a clamping device for the control sheet is pivotally secured, said device comprising an upper clamp 2 and a lower clamp 3; for a carbon sheet or the like to be laid on the control sheet the clamping device is provided with a clamp 4 located between the clamps 2 and 3. By means of a handle 5 the clamp 4 may be opened from the clamping position in which it is held by a spring (not shown), whereas by means of a manually operable shackle 6 the upper and lower clamps 2 and 3 may be turned up against spring action; the construction is further such that the shackle 6 bears upon the handle 5 and that by pressing down the shackle the handle may also be pressed down; the control sheet with carbon sheet may thus be clamped or loosened together or separately.

The table 1 is held by means of non-shown supporting elements at some distance above a lower plate 7. Between this lower plate and the table are located guide means (to be described hereinafter) for the carriage which is movable over the table and is constructed as a vertical ruler 8.

This ruler is adapted to clamp an entering sheet between an upper piece 11 adapted to be tilted by means of a handle 10 (Figure 1) against the influence of a spring 9 (Figure 2) and a lower piece 12. The upper piece 11 carries a dovetail shaped longitudinal ridge 13 serving as a guide for a slide or sliding piece provided with a corresponding dovetail shaped groove. To the sliding piece a horizontal ruler 15 is secured serving as a line-indicator. The line space is marked by means of recesses 16 in the ruler 8 with which the sliding piece can co-operate. The vertical ruler and its accessories is at 17 (Figure 1) hingedly secured to a carrier 25. At its lower end (Figure 1) it carries a projection 18 which is received in a recess 19 of an end-piece 20 and is adapted to be locked thereto by means of a pin 21 with operating knob, said pin passing through the end piece and extending into an opening 23 of the projection 18. The end-piece 20 is secured to the carrier 25 by a connecting piece 24, said carrier extending underneath the table in the direction of the ruler 8 and being connected at its upper end to the lower half of the hinge 17. The carrier 25 is provided at its upper and lower side with a lateral or horizontal arm 26 for a purpose to be described hereinafter.

To the lower plate 7 at the top and at the bottom a strip 27 and 28 respectively is secured, wherein a zigzag-shaped guiding groove 29 and 30 respectively is formed. A larger number of grooves might be used so as to obtain a greater stability. Above said guiding grooves the lateral or horizontal arms 26 are located. In the guiding groove 29 and 30 pairs of balls 33, 34 and 35, 36 are running, said pairs being spaced apart

a distance determined by the zigzag groove and being equal for each pair mutually.

Further there are pairs of balls of which one set 37, 38 is shown in Figure 2. These balls are located in openings of the arms 26 referred to above and are each pressed upwardly against a strip 31 and 32 resp. by a leaf spring 39. Consequently the balls 33, 34 are held down in the guide grooves 29, 30. The balls are located pairwise in vertical planes in the direction of the ruler 8. The pair of balls 33, 35 is located in corresponding turning points of the mutually equal zigzag-shaped grooves 29, 30. The same applies to the balls 34, 36. As appears from Figure 1, the zigzag-shaped configuration of the guide grooves 29, 30 is of a peculiar nature correlated with the entering method according to the invention. Assuming that the position of the ruler 8 in Figure 1 be the neutral or central position then it appears that from the points 33/35 and 34/36, where the balls in question are located, towards the left and the right equal but oppositely and downwardly inclined groove portions 40 extend merging at 41 into upwardly inclined groove portions 42. The points 41 are located a line space lower than and a fixed distance to the left from the point 33/35 and the end points 43 of the groove portions 42 are located two line spaces higher than the points 33/35 and again a fixed distance to the left from 41. The groove portions 42 are oppositely upwardly inclined considered from the neutral position of the ruler. The portion of the zigzag-shaped guide grooves 29, 30 located in Figure 1 at the right of the endpoint 44 of the upwardly inclined groove portions 42, situated at the right of the neutral ruler position, is fully equal to the portion 42, 43, 40, 42 of said guide grooves and serves for the guiding of the balls 34, 36.

If the ruler 8 is laterally shifted to the left or to the right from the neutral position in Figure 1 the ruler is by means of the balls 33, 35 and 34, 36 compelled to follow the zigzag-shaped path; the remaining balls will then function as rolling elements running against the strips 31, 32 and serving only to keep the other balls 33, 35 and 34, 36 respectively in their grooves.

On account of the change of direction of a groove portion of a certain incline when merging into a groove portion of another incline there are formed arresting places for the balls e. g. in rounded corners of the broken line forming the zigzag path which arresting places have a light breaking effect on the shifting movement of the ruler and make it possible to effectuate a required displacement with certainty in the right manner and stepwise.

Now, the entering method according to the invention will be explained with reference to Figures 4–10.

In Fig. 6 the ruler 8 with the entering sheet 45 clamped thereto is located in the neutral position also shown in Fig. 1. On the table 1 a control sheet 46 and thereon a carbon sheet 47 have been laid, which sheets are clamped in the clamps 2, 3 and the clamp 4 resp. and therefore have a fixed position. The control sheet and the entering sheet, after some entries have been made thereon by carrying out the method according to the invention, are shown in Figures 9 and 10 resp. It appears therefrom that on the entering sheet 45 according to the Staffel-method and on the control sheet according to the tabular method the entries have been made under the headings NT (new count), OT (old count) and M (mutation).

For the sake of simplicity only some entries in the debit will be described. Entering in the credit has therewith the only difference that the ruler is shifted from the neutral position to the right instead of to the left.

Assuming that on the entering sheet 45 (marked A) in the debit appears an old count 1500 and that this count is subjected to a mutation of 500, the horizontal ruler 15 is adjusted at 1½ line space below the line of the old count in order to make it possible to write well on the entering line of the entering sheet. First the mutation 500 is written on the entering sheet and by means of the carbon sheet is simultaneously produced on the control sheet. The ruler 8 is now shifted to the left from the neutral position in fig. 6 and is thereby brought in the position of fig. 5. The downwardly inclined groove portions 40 of fig. 1 are thereby followed and the displacement vertically is one line space and horizontally a given distance. Now the old count 1500 appearing on the entering sheet which moved along with the ruler 8 is traced dry, e. g. by means of a blunt upstanding point with which the pen holder is specially provided to this end. The carbon sheet 47 again takes care of the transmission to the control sheet. Thereupon the ruler 8 with entering sheet is shifted to the left and brought in the position according to figure 4. The groove portions 42 in fig. 1 are thereby followed and the displacement vertically is a double line space and horizontally again a given distance. Now, on the entering sheet the new count is entered by addition of the old count and the mutation and is simultaneously produced on the control sheet. On the entering sheet the amounts 1500, 500, 2000 now appear below one another and these amounts appear in tabular form, i. e. adjacent one another on the control sheet.

The positions of the ruler 8 with entering sheet and horizontal ruler 15 shown in figures 7 and 8 correspond with corresponding entries in the credit, of which, after what has been said in the foregoing, no example will be needed.

According to figures 9 and 10 some entries according to the novel method have been made on the entering sheet A and the control sheet, and on the control sheet the new counts, old counts and mutations have been added. Now, it appears that in this case the sum of the new counts is 100 in excess of the total of the sums of old counts and mutation. It follows that somewhere on the entering sheet a mistake must have been made. This mistake is now detected and appears to have been made in the last entry. The entering in tabular form on the control sheet thus constitutes a control of the entering according to the Staffel-method on the entering sheet.

In the manual writing method explained above use may be made of a fountain pen or other writing utensil, which according to the invention is provided with a separate tracing element, which in a fountain pen may consist of a pinlike writing pen having an upturned point located at some distance above the writing pen and therefore being left without ink.

If the entries are not made by hand writing but by machine writing then in the latter case a carriage of an apparatus for carrying out the method according to the invention connected to the carriage (underlayer for the control sheet) of the type writer moves along with the type-

writer-carriage to the left. In connection herewith the apparatus-carriage, at any time after the type-writer-carriage has come to rest and an entry has been made, will have to be displaced by hand to the right over the required path portion of a positive guide means also used in this case, in order to have in the following entering operation by machine writing said entry appear in tabular form on the control sheet clamped in the type writer.

This implies that the entering sheet will have to be provided with a blank column between debit and credit side in order to prevent column amounts on the control sheet from overlapping one another. It is not possible as in the hand writing method to start from a neutral position of the apparatus-carriage for debit and credit side since the type-writer-carriage during writing is always moving to the left and the apparatus-carriage is exclusively shifted to the right so as to obtain a positive relative movement of entering sheet and control sheet. Essentially, however, the method remains the same. It will be clear that the apparatus will have to be adapted structurally to its arrangement on the type writer.

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PUBLISHED MAY 25, 1943. BY A. P. C.

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METHOD FOR PRODUCING A CONTROL SHEET, ETC

Filed Aug. 12, 1941

Serial No. 406,566

3 Sheets-Sheet 1

Fig. 1.

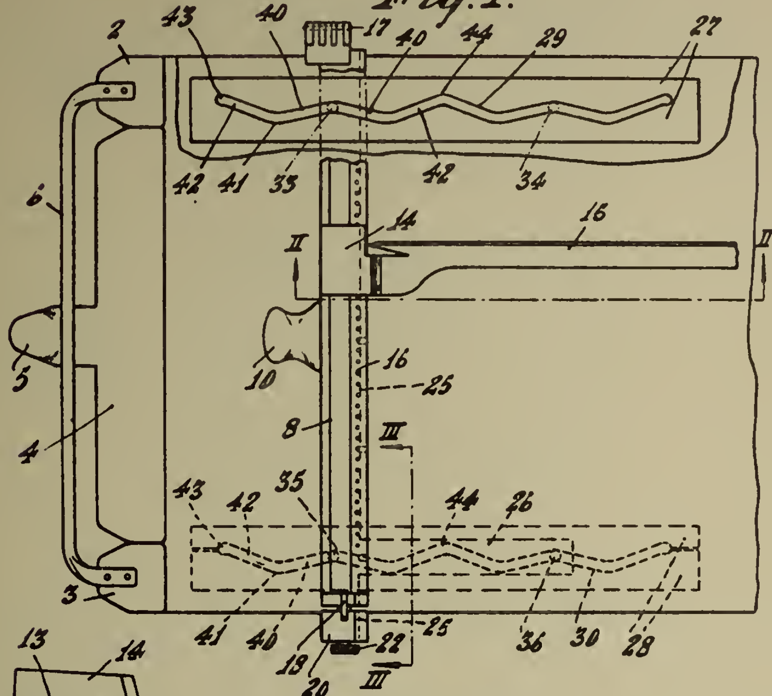

Fig. 2.

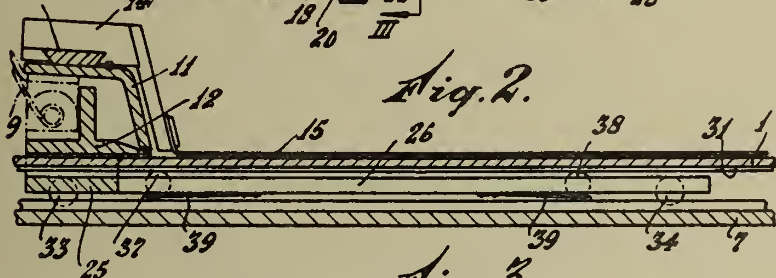

Fig. 3.

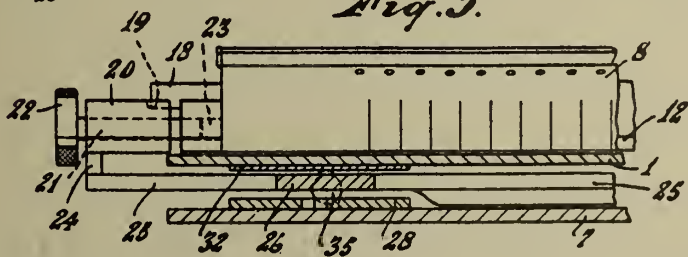

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Fig. 4.

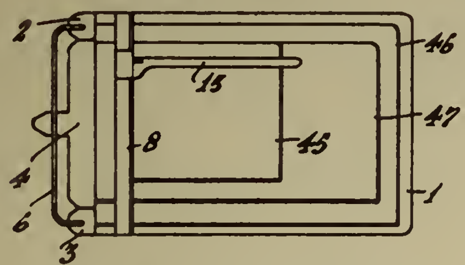


Fig. 5

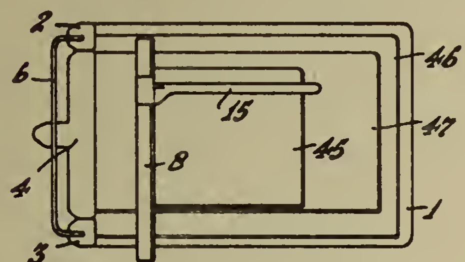


Fig. 6.

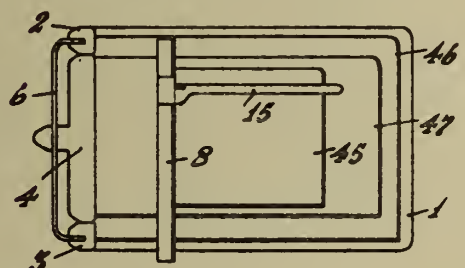


Fig. 7.

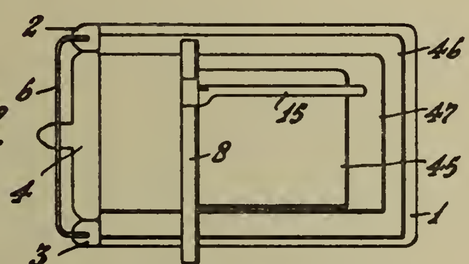
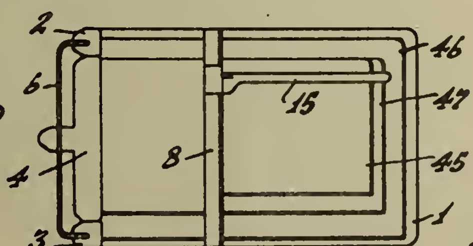


Fig. 8.



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Serial No.
406,566
3 Sheets-Sheet 3

Fig. 9.

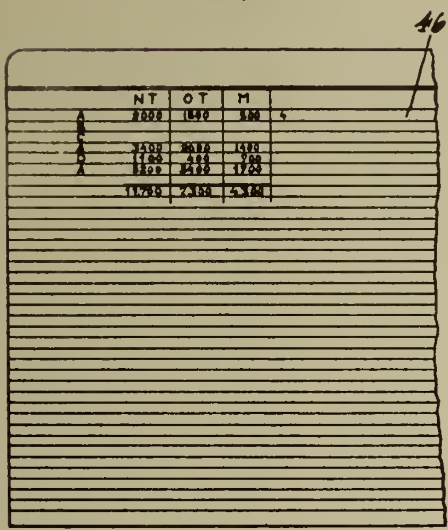
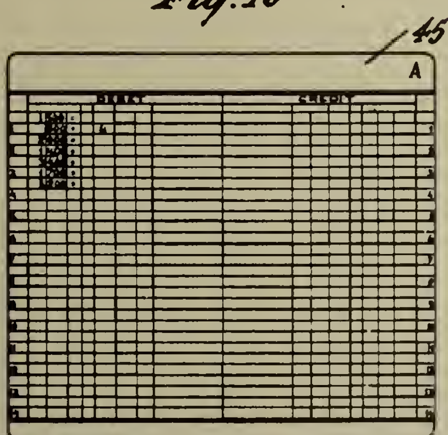


Fig. 10



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Published May 25, 1943

Serial No. 407,735

ALIEN PROPERTY CUSTODIAN

SECONDARY ELECTRON AMPLIFIERS

Adrianus J. W. M. van Overbeek, Eindhoven, Holland; vested in the Alien Property Custodian

Application filed August 21, 1941

This invention relates to an electron discharge tube comprising a secondary emission electrode having a surface which has the property of emitting secondary electrons when struck by a stream of primary electrons.

In electron discharge tubes comprising a secondary emission electrode located behind an apertured or grid-like anode the primary electrons traversing the anode will impinge upon the secondary emission electrode and the secondary electrons dislodged from the emitter find their way to the anode either directly or after traveling several times around the anode surface. Such constructions, more particularly where both the anode and the secondary emission electrode can be seen from the cathode, have the drawback that the interelectrode capacities, especially between the anode and the grids interposed between anode and cathode, may become fairly large. In addition, the internal resistance of the tube is greatly reduced especially in the case of short waves, because the secondary electrons, before finding their way to the grid-shaped anode, may oscillate several times to and fro around the anode.

The principal object of this invention is to provide a simple and sturdy secondary electron emission tube which has low interelectrode capacitance and in which the internal resistance does not change materially, even when the tube is used for short waves.

According to the present invention an electron discharge tube comprises an electrode system including a cathode or similar source of primary electrons, at least one secondary emission electrode, and an anode, preferably a rod or strip, so placed that as viewed from the cathode it is behind a shield member, preferably a rod parallel to and in front of the edge of the anode. The shield member is maintained at a constant, preferably cathode, potential. The primary electron stream may be controlled by a control grid near the cathode. To advantage the secondary emission electrode is concave or recessed, facing the cathode and surrounding the greater part of the anode, so that the secondary electrons go directly to the flat sides of the anode.

In a preferred and illustrative embodiment of the present invention the concave secondary emission electrode surrounds the anode, save on the side facing the cathode, and the primary electrons are formed into a beam by beam forming means, such as a number of rod-shaped members, preferably near the anode shield rod. The beam impinges on the inner surfaces of the secondary emission electrode at such a point that substantially all secondary electrons pass directly to the anode without oscillating around or near it, and practically none of them return to the vicinity of the control grid.

The invention will be more fully explained by reference to the accompanying drawing wherein one embodiment thereof is schematically represented in Figure 1, and in more detail in Figures 2 and 3.

The drawing shows an electron discharge tube having a source of primary electrons, such as an indirectly heated oxide coated thermionic cathode 1, near which is a conventional control grid 2. A conventional screen grid 3 may be used, and beyond the grids is an output electrode or anode 4, preferably a flat strip or slat set edgewise to the cathode. Beyond the anode is a secondary emission electrode or emitter 5, preferably concave or recessed, which partly surrounds the anode 4 and is open to the cathode 1. Between the cathode 1 and the anode 4 there is a shielding member such as a rod 6 which is interposed between the cathode and the edge of the slat anode and protects the anode from the primary electron stream indicated by heavy arrows. The rod 6 is maintained at constant potential, such as cathode potential, either by a direct connection to the cathode inside the tube or by an external connection. I have found it advantageous to provide means, such as rods 7 which may also be connected to the cathode, to form the electron stream into a beam which impinges on the secondary emission electrode at points so situated that practically all of the secondary electrons emitted are drawn directly to the anode, as indicated by light arrows. As the inner or emitting surfaces of the concave emitter are the walls of a recess in which is the slot anode with its flat sides directly exposed to the emitting surfaces, substantially none of the secondary electrons from the emitter return to the vicinity of the control and screen grids. For convenience, the beam forming rods 7 may be parallel to and beside the shield rod 6, which splits the beam into two parts, each of which impinges on an emitting surface of the emitter 5.

Figures 2 and 3 show in more detail a tube made in accordance with the invention and comprising a highly evacuated bulb 10 enclosing the electrode assembly, which in general is of conventional construction, with the electrodes held between a pair of mica spacers secured to support rods. It is desirable, as shown in these figures, to provide by sheet metal shields good

electrostatic shielding between the electrode leads and for the upper ends of the grid rods. The shields may conveniently be attached to electrodes 6 and 7, which may operate at ground potential. The emitters 5 may to advantage be approximately V-shaped in cross-section, and blackened on the outer surface, for example, by carbonizing, to facilitate heat radiation and thereby keep the emitters comparatively cool during operation. The inner surface of the emitters 4 may be made to have high secondary electron emissivity by well known expedients, such as oxidizing the surface and then caesiating it, or by coating the surface with a very thin film of alkaline earth oxide. For example, the emitter 4 may be made of copper, with the emitting surfaces oxidized and subjected to an atmosphere of caesium vapor. Such an emitter has good stability and is only slightly affected by material thrown off from the oxide coated cathode 1 during operation of the tube.

The accompanying drawing shows schematically only part of the electrode system, but obviously several parts, each comprising a secondary emission electrode and an anode, can be provided for a common cathode and on one electrode assembly.

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SECONDARY ELECTRON AMPLIFIERS
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Fig.1.

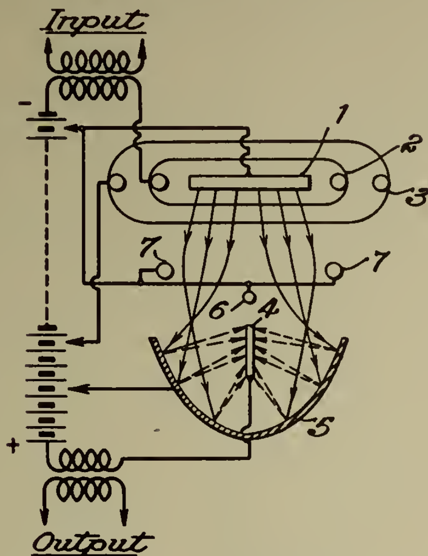


Fig.2.

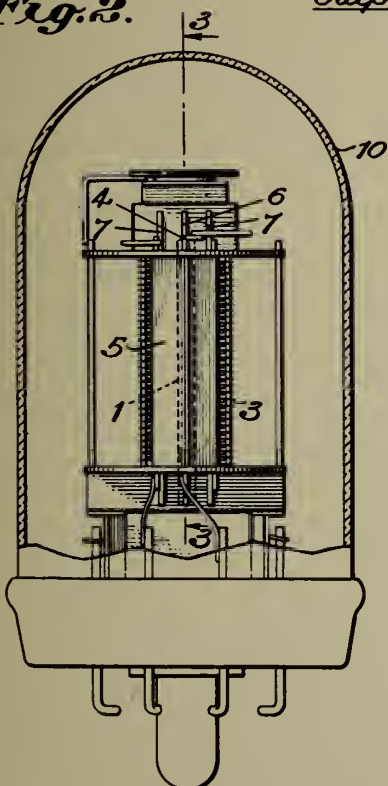
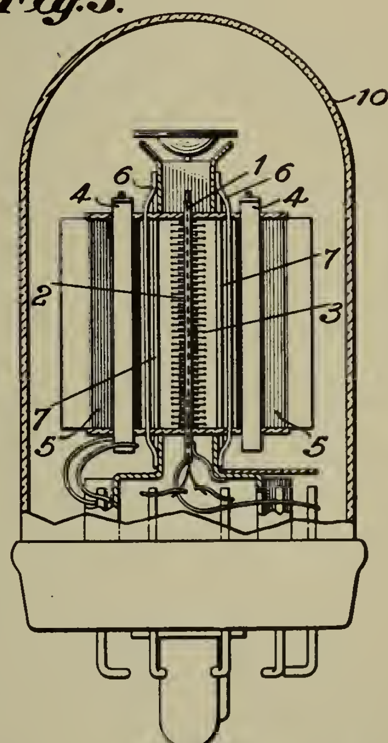


Fig.3.



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ALIEN PROPERTY CUSTODIAN

ELECTRON DISCHARGE DEVICES

Johan Lodewijk Hendrik Jonker, Eindhoven, Holland; vested in the Alien Property Custodian

Application filed August 21, 1941

This invention relates to an electron discharge device of the variable mu type in which the mutual conductance may be varied or controlled in response to control voltages, such as those used in automatic volume control.

The so-called "variable mu tubes" usually comprise one or more grids having a variable pitch or two or more grids between which the distance is unequal at various points along the grids so as to ensure a gradual decrease in mutual conductance with increasing negative bias or grid voltage with reference to the cathode. The anode-current grid-voltage characteristic of a variable mu tube may be imagined to be made up of the individual characteristics of small parts or portions of the grid. For instance, in a variable mu tube having a grid with apertures of various sizes the smallest apertures through which consequently a comparatively small electronic stream passes will impart to the tube a characteristic having a steep slope, and to this small stream is then added the much larger electronic stream passing through the large apertures, which impart to the tube a characteristic having much less slope. This tube characteristic may be imagined to be the resultant or sum of these characteristics for each individual aperture, and is of gradually decreasing slope. At minimum grid bias the discharge passes through all of the apertures, the mutual conductance characteristic is predominantly that due to the smaller apertures, and therefore its slope is steep and the anode current is a maximum. As the grid bias increases and the grid becomes more negative, the discharge through the smaller apertures stops, the mutual conductance is determined principally by the larger apertures and therefore its slope is less, and the anode current decreases. It has been found difficult to construct such tubes which have a very steep slope of the anode current grid voltage characteristic without at the same time having an undesirably large anode current at minimum grid bias where the slope is very steep. If the distance between two grids through which the discharge passes in succession is not equal throughout the length of the grids, the characteristics for different points along a grid will have different slopes, so that electric discharge tubes having grids between which the distance varies along the grids will also have a grid voltage-anode current characteristic whose slope will gradually decrease. It has been customary to operate a variable mu tube at different points along this characteristic by varying the grid bias, in spite of the drawback that upon adjusting the grid bias to operate the tube where the characteristic has very steep slope the anode-current is much higher than necessary for attaining this slope.

The principal object of the invention is to provide a device having a mutual conductance which can be readily controlled or regulated so as to vary between high mutual conductance and low mutual conductance without changes in the bias of the control grid, and preferably with a very continuous and uniform variation in mutual conductance.

According to the invention the different characteristics imparted to the tube by the different portions of the grid are in effect used individually and practically unaffected by other portions of the grid. Preferably the device is so made that there can be obtained a very continuous transition from one of these characteristics to another, such as from high mu to low mu. To this end the electron discharge is concentrated into one or more electron beams shifted along a signal grid of the variable mu type by beam control or deflecting members. Preferably two or more grid-shaped electrodes are placed in the path of the beam so as to be passed successively by the beam, one of the grids being sufficiently irregular with reference to the other tube elements, as, for example, by being inclined to the other grid to cause the mutual conductance of the tube to vary along the grids in a direction in which the electron beam can be deflected. This construction in which the distance between the signal grid-plane and another grid-plane varies along the grids is a simple way of obtaining an uneven potential in a grid-plane through which the beam passes.

By varying the difference of potential between deflecting members on opposite sides of the electron beam path the beam can be directed and the discharge practically confined to different sections of the gird which impart different grid voltage-anode current characteristics to the tube. If the spaced grid conductors extend parallel with the direction in which the electron beam can be deflected, the transition between the different characteristics will be very gradual and will not change abruptly, as might occur at each aperture if the grid conductors were spaced non-uniformly and extended transversely of the direction of deflection of the electron beam. Thus, according to the invention, a great variation in the slope of the grid voltage-anode current characteristic is obtainable without the attainment of steep slopes being accompanied by undue increase of the anode current.

An electron discharge device according to the invention is very useful in various circuit arrangements, such as those for automatic volume control, as the voltage of the automatic volume control can vary the difference in potential between the deflecting members and the device will automatically adjust itself in accordance with the signal strength to a definite grid voltage-anode current characteristic of a definite slope.

The invention will be more clearly understood by reference to the accompanying drawing, which represents schematically one embodiment of the invention.

The particular embodiment of the device shown in the accompanying drawing comprises an electron discharge tube having an evacuated envelope 1 enclosing electrode elements arranged to constitute a variable mu or variable amplification factor tube having an anode or output electrode 2 and a source of electrons for directing an electron beam to the anode, such as an indirectly heated cathode 3 and a beam forming electrode, such as a cylinder 4 coaxial with the cathode and having a slot or opening in one side. The electrons emitted by the cathode are formed into an electron beam 5 which, in the particular construction shown in the drawing, is a flat-sided or ribbon-like beam substantially rectilinear in cross-section and directed to the anode 2. Interposed between the anode and the source of electrons is a grid electrode 6 which comprises a rectangular frame and a plurality of spaced parallel conductors 7 extending lengthwise of the frame and may be used as a control grid.

Preferably a second similar grid electrode 8 is interposed between the control grid 6 and the anode 2, and is connected to act as a screen grid. The control grid 6 is so related to the other elements of the tube, preferably by being inclined to the anode, so that one end is nearer the anode than the other, as indicated in the drawing, that the grid electrodes 6 and 8 constitute a grid structure which is sufficiently irregular with reference to the other elements of the tube to give the tube a different mutual conductance or amplification factor at different positions of the beam 5 along the conductors of the grid 6. In the particular construction shown the upper end of inclined grid 6 is nearer the anode, and grid 8 is parallel to the anode. When the beam is at the position A near the upper end of the grid 6, the mutual conductance or amplification factor is high and the tube acts as a high mu tube, and when the beam is near the other end of the grid at position B, the amplification factor is low and the tube acts as a low mu tube. By shifting the beam 5 along the grid 6 lengthwise of the grid conductors 7, a very regular and continuous change in mutual conductance from high mu to low mu can be obtained.

The tube may be regulated to operate at will with any selected amplification factor within the range of the tube by control means for deflecting the beam lengthwise of the conductors 7 of the grid 6, such as deflection plates 9 and 10 positioned between the electron source and the grid 6 on opposite sides of the path of the beam to provide a passage for the beam. The position of the beam on the grid 6 will depend upon the difference of potential between the deflection plates 9 and 10, and by varying the potential of the plate 10, for example, the beam can be deflected and field at any selected point on the grid 6.

For clearness of illustration, the tube is shown as of the elongated type, but obviously the tube can be made of cylindrical construction and the beam 5 instead of being a flat ribbon-like beam can be a circular disc beam such as may be obtained by known constructions as, for example, U. S. patent to Hamacher, 2,090,001. In this case the two grids and the anode are obviously in the form of rings or cylinders to correspond to the shape of the circular disc beam.

The variation in potential on the deflection plate 10 to determine the position of the beam on the grid 6 may be obtained in various ways, but for purposes of illustration, the device is shown for use in automatic volume control with the tube connected to a conventional automatic volume control circuit of a construction and operation well known in the art. As shown, an input circuit 11 is connected to the control grid 6 which can be biased as desired by a grid bias connection 12. The output circuit 13, connected to the anode 2, includes the usual diode rectifier 14 connected to the conventional diode resistor 15 from which the audio frequency network is supplied. One end of the diode resistor 15 is connected through the usual filter network 16 to the automatic volume control connection 17 leading to the preceding tubes of the set. This automatic volume control connection 17 is connected by a lead 18 to the deflection plate 10 so that the voltages developed upon the connection 17 will be impressed upon the deflection plate. The circuit is supplied from the usual voltage divider 19 which is connected to the various elements of the circuit and tube in the conventional way.

In operation, the electron beam 5 shaped as a broad thin band or ribbon is deflected along the grid 6 by the deflection plates 9 and 10 so that this beam impinges on the grid 6 at different points in accordance with the differences in potential between the deflection plates. Owing to the difference in spacing between the grids 6 and 8 at different points along the grids, a different anode current-grid voltage characteristic is obtained at different points along the grid 6 so that in accordance with the potential on the deflection plate 10, the tube will operate with different mutual conductance characteristics. When the signal strength is high, the voltage impressed on the deflection plate 10 will be sufficiently high to pull the beam 5 to the position B, where the mutual conductance of the tube is low. When the signal is weak, the voltage on the deflection plate 10 is lower, the beam assumes the position A, as shown in the drawing, and will be directed through the control grid 6 at a point where the mutual conductance or mu of the tube is high. Since the grid conductors 7 extend in a direction parallel with the direction of deflection of the electron beam, the transition between the different characteristics at different points of the grid 6 will be very regular and continuous, with the mu factor decreasing regularly and continuously as the control voltage on the deflection plate 10 increases with increasing output.

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ELECTRON DISCHARGE DEVICES

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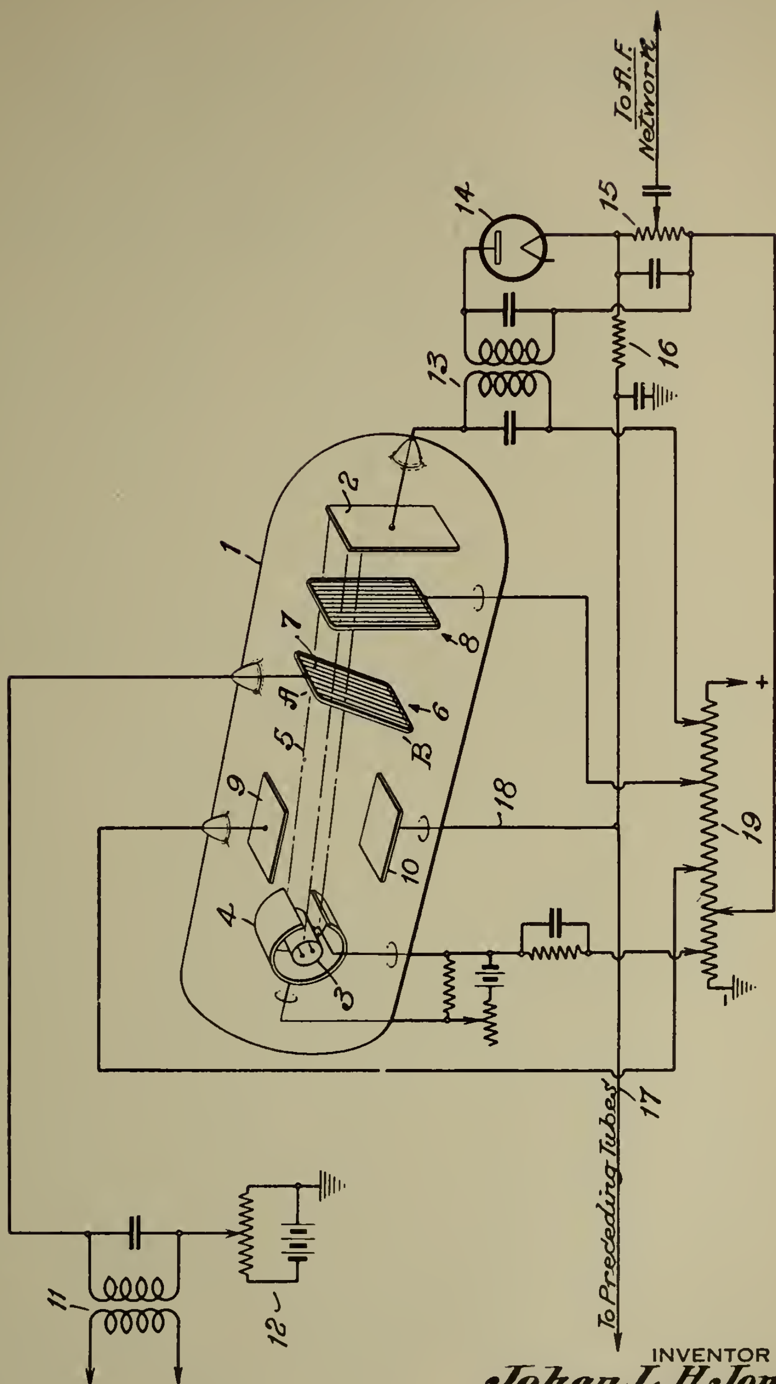

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ALIEN PROPERTY CUSTODIAN

ELECTRONIC MICROSCOPES

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Application filed August 29, 1941

This invention relates to improvements in electronic microscopes.

The electronic microscopes hitherto employed present the disadvantage in that they are relatively sensitive to vibrations. If when taking pictures of the object slight vibrations of the microscope occur, the latter cause unsteady pictures. As tests have shown, these faults are brought about by the fact that in the known electronic microscope slight oscillations may occur between the object and the objective. In the case of magnifications of 10^{-4} to 10^{-5}, amplitudes of 10^{-5} to 10^{-6} exert a disturbing effect. This sensitiveness to vibrations is present to a slight extent in such electronic microscopes in which the object carrier is firmly secured to the objective.

The object of the present invention is to provide also such constructions of electronic microscopes insensitive to vibrations in which the object carrier is independent of the objective so that it is not necessary to remove the objective itself from the microscope when replacing the object. Such constructions are employed in order to enable a rapid introduction of the object into the vacuum chamber. This is accomplished according to the invention by pressing the objective carrier against the stationary part of the objective lens with the aid of a spring so that relative movements between the object and the objective lens are prevented. In the known electronic microscopes which employ an object cartridge for sluicing the object into the vacuum chamber, the invention may be carried into practice in the manner that the object carrier is so supported as to be axially displaceable within the cartridge against the compressive force of a spring. The arrangement may then, for instance, be so designed that the object carrier projects from the cartridge at the side facing the objective lens and is pressed in the operating position with a contact surface against a corresponding surface of the objective.

In the accompanying drawing is shown an embodiment of the invention in diagrammatic form. In the drawing is shown a longitudinal sectional view of the part of an electronic microscope arranged above the objective, 1 denotes the stationary vacuum chamber wall of the microscope. A sluicing device 2 designed in the form of a cock plug serves to sluice the object into the vacuum chamber 3. 4 denotes the object cartridge in the operating position in which the cartridge is pressed out of the sluicing chamber 3 with the aid of a driving rod 5 in the direction towards the objective 6. The upper holding ring 7 of the cartridge is under the pressure of the spring 8 which presses back the cartridge into the sluicing chamber 3 when the rod 5 moves in the upward direction. The object carrier film is applied in the known manner to an object diaphragm 10. This diaphragm is arranged in a holder 11 and clamped with the aid of the screw 12. The screw 11 projects as shown from the holder 11. The screw 12 is threadedly attached to a guide part 13 which is under the action of the spring. As indicated at 14 lugs which fit in corresponding slots 15 are provided inside the cartridge. These slots are arranged in the guide part 13. In the relieved state, the spring 9 therefore presses the guide part 13 in the downward direction until it comes into engagement with the stop 16. In this case, the slots 15 and the lugs 14 prevent the guide part 13 from being rotated when screwing on the screw 12. In the operating ing position shown the contact surface 17 of the holder 11 is in engagement with a corresponding surface 18 of the upper pole shoe 19 of the electromagnetic objective lens. 20 denotes the second pole shoe of the lens. Between the parts 13 and 4 there is a slight clearance as indicated at 21. 22 is a guide body into which the cartridge is pressed in the operating position. Vibrations which may produce oscillations between the objective lens and the cock plug 2 are no longer the cause of faulty images in this arrangement, since the objective holder, in the operating position shown is firmly pressed against the upper pole shoe 19 by the spring 9. Consequently, relative movements between the object carrier and the objective are no longer possible. The invention may also be applied to ion microscopes.

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ELECTRONIC MICROSCOPES

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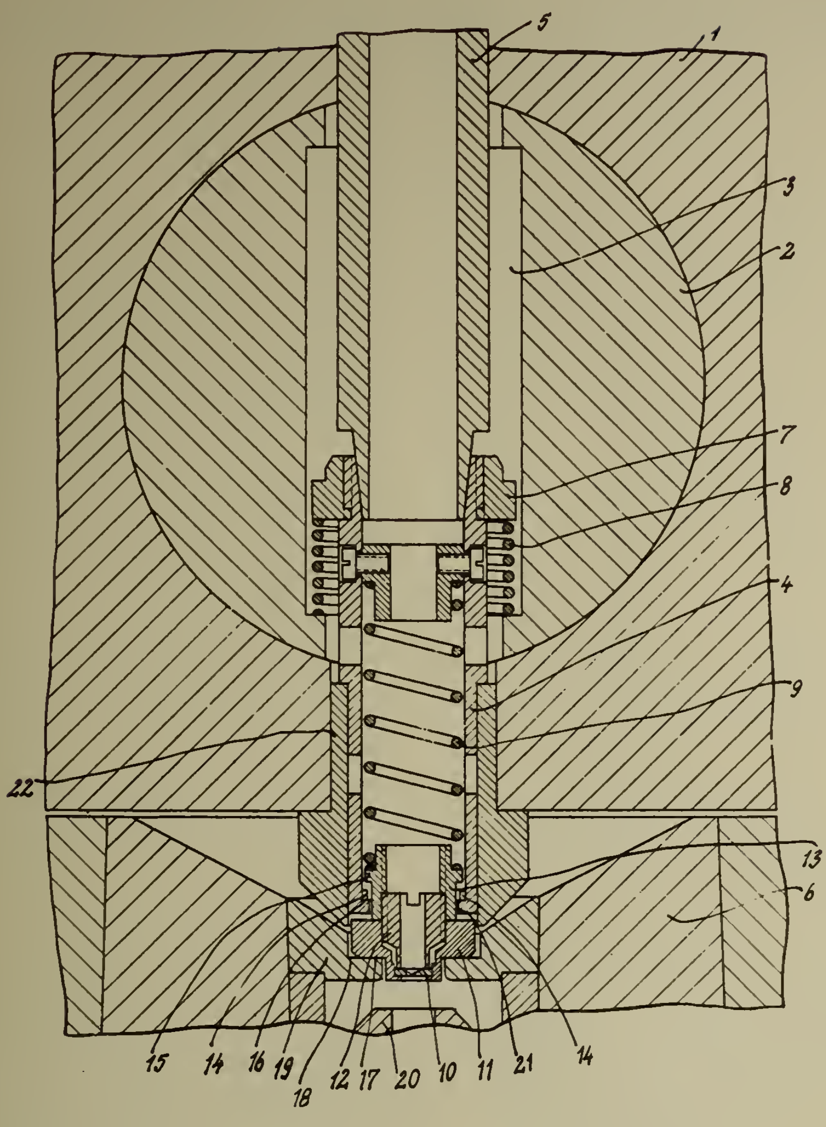

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Published May 25, 1943

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ALIEN PROPERTY CUSTODIAN

RACQUET STRINGING MACHINE

Martin Caro and Gustave Lambet, Brussels, Belgium; vested in the Alien Property Custodian

Application filed September 2, 1941

This invention relates to a device for stringing tennis, badminton, squash and like racquets.

For stringing racquets a frame is usually used which has two movable jaws which can be moved towards and away from each other and parallel to themselves by means of a screw and nut arrangement so that the frame of the racquet to be strung is held along its longitudinal axis and a rigid support for the racquet is therefore provided during the stringing.

The machine in accordance with the invention which is very simple and at the same time very strong uses the principle of the above-mentioned frame which allows speed and regularity which are characteristic of mechanical operations to be combined with the numerous advantages of hand stringing.

In accordance with the present invention, the frame in which the racquet is held is mounted on a vertical pivot so that the racquet can be displaced parallel to itself in a horizontal plane as required.

A tensioning device can be used which consists of a graduated lever provided with a removable sliding counterweight which can be fixed to the lever by means of a screw in any desired position along the length of the lever according to the required tension.

In order to obtain the exact tension which is required, it must be possible to disconnect the lever from the tensioning drum to enable the apparatus to be adjusted so that the lever can reach its horizontal position, that is to say, its position of maximum tension.

To this end, in accordance with the invention, use is made of a device which allows the starting point of the counterweighted lever to be localised relatively to the tensioning drum and by means of an appropriate sector while allowing the lever to make the necessary stroke to allow it to have its maximum effect, that is to say, to reach the horizontal position.

The stringing machine in accordance with the invention relates also to other features which will appear in the course of the following description. The accompanying drawings show by way of example one method of carrying the invention into effect. The latter extends to the various new features to be found in the arrangement shown.

Figure 1 is a perspective view of the machine during the putting in of the cross-strings.

Figure 2 is an elevation to a larger scale of the parts through which the strings are tensioned when only a light tension is required. The corresponding parts shown in Figure 1 are those used when a relatively high tension is required.

Figure 3 is a perspective view of a clamp used when putting in the mains and

Figure 4 is a view of a clamp used when putting in the cross-strings.

The machine shown in the drawings comprises essentially a frame in which the racquet is rigidly held in a constant position during the stringing operation, a device for tensioning the strings, clamps for maintaining the tensioned strings under tension as the stringing progresses, a rigid supporting frame for said clamps.

The frame in which the racquet is held during the stringing (see Figure 1) has two jaws **2** which grip the frame of the racquet in the direction of its longitudinal axis.

The racquet is held in the jaws **2** by means of a screw **3** provided with a tongue **4** and by means of a tongue **5** which is hinged to a part **6** which is removable from the rigid frame. The tongue **5** is held by a bolt **7** which can be screwed into a hole in the member **6**.

This frame is pivotally mounted on a fixed base **8** so that it, and therefore the racquet, can be turned in different directions in a horizontal plane at different stages during the stringing.

The tensioning device consists of a graduated lever **9** hinged at **10** and provided with a sliding counter-weight **12** which can be fixed to the lever by means of a screw **13**.

A pawl **15**, pivotally mounted on one of the faces of the lever **9**, engages, under the influence of a spring in the teeth of a sector fixed to the tensioning drum **17**. The periphery of the drum **17** has a rubber coating **18** and is provided with a screw **19** and washer **20** to which the gut is fixed during the tensioning.

The other face of the lever **9** carries a sliding rod **21** which can be displaced by pressing on its end **22** at the free end of the lever.

At the lower end of the said rod there is a sector **23** which is urged into an inoperative position by means of a spring **24**. The sector **23** acts on the end of a pawl **25** mounted on a fixed pivot **26**. A stop **27** carried by the drum bears against the end **28** of the pawl **25** which is maintained in its locking position by means of a spring **29**.

The support for the drum and for the tensioning lever slides along a guide forming part of the framework of the machine.

It is to be noted that the placing in position of the cross-strings differs only from that of the mains in the use of a separating device which can be of the type described in a patent appli-

cation No. 275,977. The cross-stringing operation only will therefore be described in full detail.

The end of the gut is introduced into the eye of a flexible needle the displacement of which is guided by the upper and lower mains.

The flexible needle is slipped into the free space provided by the separating device. The end of the string to be tensioned is then introduced into the eye of the needle which is pulled in the opposite direction, thus pulling the string which, after its introduction into the corresponding hole of the frame, can be tensioned in the same manner and with the same effectiveness as the mains without rubbing on the latter because they are drawn apart.

The gut is then wound round the tensioning drum and is wedged between the washer **20** and the flexible coating **18**. The lever **19** is then liberated and is turned, carrying with it the tensioning drum **17**. The tension in the gut increases until the lever reaches its horizontal position in which the moment of the counterweight **12** is at its maximum.

The desired tension is obtained by the displacement of the counterweight along the graduated lever.

The momentary releasing of the lever **9** from the drum **17** allows the point from which the lever **9** starts so as to arrive in the horizontal position to be determined. This starting point varies according to the length of the string to be tensioned and its elasticity.

When the string is tensioned, it is held in position by means of a clamp **41** placed as near as possible to the frame of the racquet and in such a way that the stirrup **42** of the rod **43** on which the clamp is mounted bears on the rod of the frame **44** opposite the clamp.

The clamps (Figures 3 and 4) comprise two jaws **45** one of which is provided with a ramp **46** on which, according to its position, acts a cam **47**. The two jaws are threaded on to a rod **43**, one end of which is provided with a stirrup **42** which allows this rod to be placed astride any one of the rods of the rigid frame **44**.

By actuating the cam **47**, the clamp is fixed on the rod **43** and the string is held between the extreme ends of the jaws **45**. When, later on, the string is liberated, the frame in which the racquet is gripped is turned through 180° and brought into a new position relatively to the lever and the operation described above is repeated.

Where a racquet has to be specially strung at a low tension, the usual counterweight **12** can be replaced by a lighter counterweight **48** (Figure 2) and a lever **49** can be attached to the tensioning lever for compensating the weight of the lever **9** itself. The lever **49** is provided with a notch which can be adjusted on the hinge pin of the tensioning lever and is driven by the latter through an abutment **50** forming part of the lever.

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RACQUET STRINGING MACHINE

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2 Sheets-Sheet 1

Fig 1

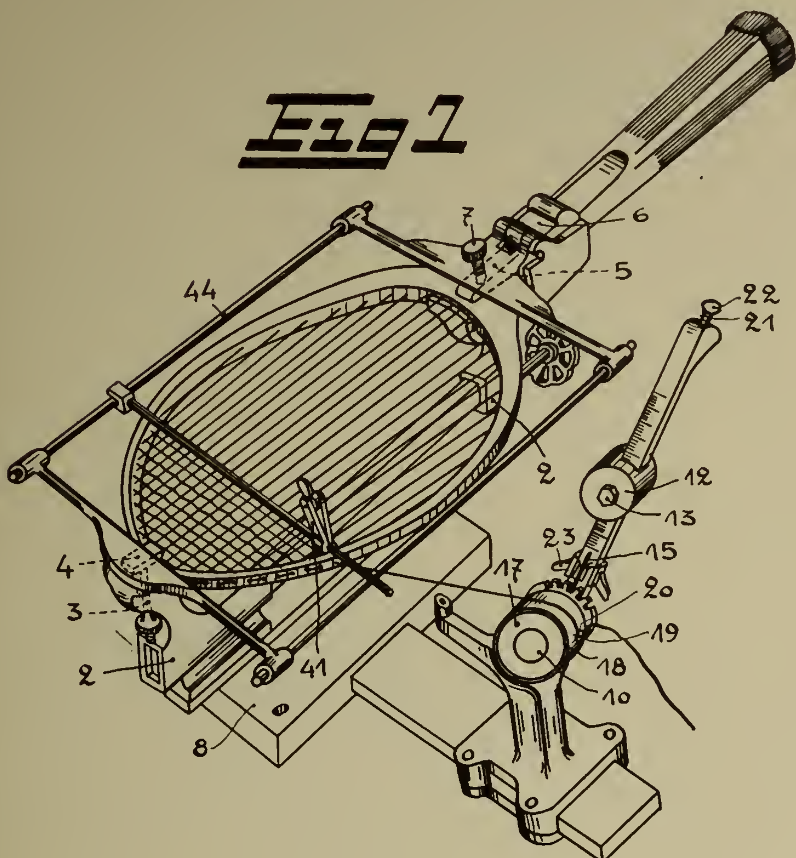

Fig 3

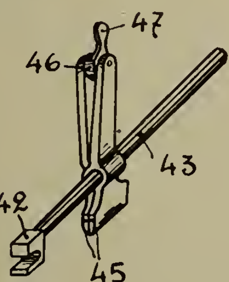

Fig 4

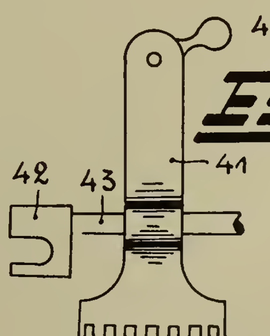

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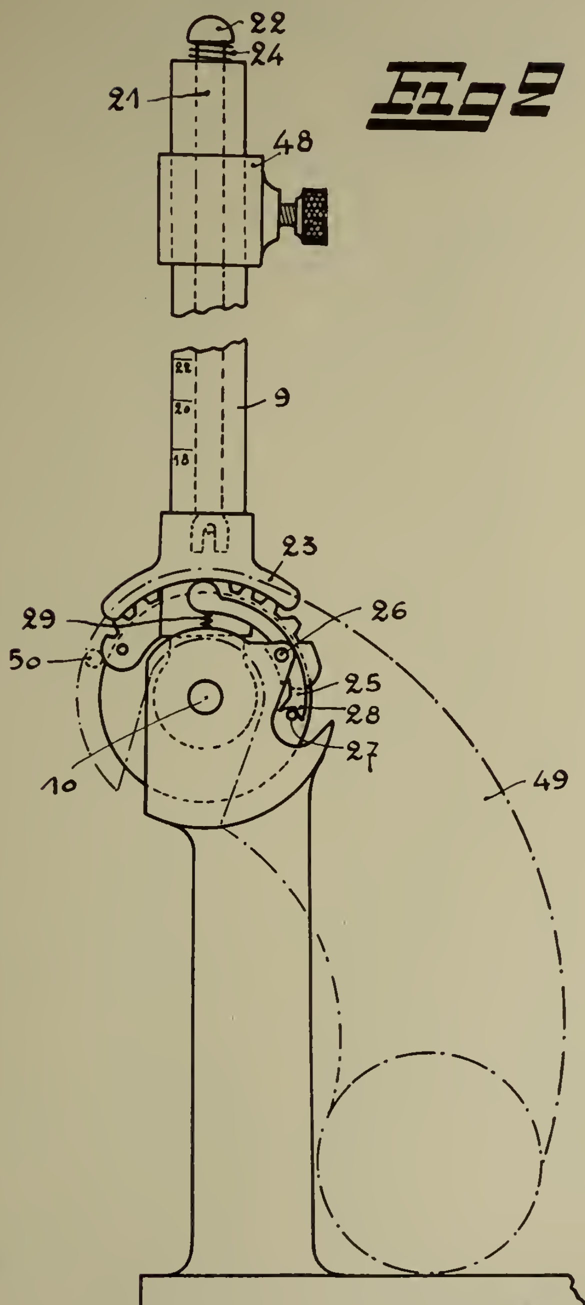
Fig 2



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ALIEN PROPERTY CUSTODIAN

APPARATUS FOR TREATMENT OF NERVES AND MUSCLES BY MEANS OF ELECTRIC IMPULSES

Preben Morland, Gentopte, and Jorgen Adolph Smith, Copenhagen, Denmark; vested in the Alien Property Custodian

Application filed September 3, 1941

The invention relates to an apparatus for treatment of nerves and mucles by means of electric impulses, especially for artificial innervation of muscles, for instance for therapeutic purposes. The apparatus according to the invention is especially adapted for use in the training of muscles.

For the above mentioned purpose, electric impulses are used the voltage curve of which may be monopolar, i. e. the voltage curve for each individual impulse is either entirely above or entirely below a voltage of repose which generally will be zero. Usually, however, the voltage curve will be dipolar, i. e. the voltage curve has one portion situated on one side of the voltage of repose, and an adjoining portion situated on the opposite side thereof. In therapeutics, such impulses are frequently called monophase and diphase or else galvanic and faradic impulses, respectively. The duration of each impulse will generally be constant and is referred to, in the following, as the impulse duration. The individual impulses are emitted in succession, in such a manner that the time interval between two successive impulses is always larger than the duration of each individual impulse.

Further, the time interval between the impulses as well as their amplitude should be able to be varied continuously and automatically. Apparatuses by which such electric impulses may be produced are known, but the possibilities of variation offered by these apparatuses are very limited, and the variations are effected by deficient mechanical means.

The present invention has for its object to provide an apparatus by which it is feasible to perform at any time the desired variations in the ranges of variation for the amplitude and time interval of the impulses, and in the manner in which the amplitude and time interval of the impulses are varying.

According to the invention, this result is attained in that the apparatus is fitted with means for producing a rhythmically pulsating current which is utilized for controlling the time interval between the individual impulses and similarly the amplitude of the same, in such a manner that the ranges of variation for the time interval and the amplitude of the impulses may be varied independently of each other. The lower limit of the said variation ranges may preferably be zero.

The rhythmically pulsating current is preferably formed by charging and discharging currents for a condenser or, maybe, by an amplification of such currents.

The apparatus may have two potentiometers through which the rhythmically pulsating current is passing, and from which the controlling voltages are taken that serve to control the time interval and the amplitude of the impulses.

The said rhythmically pulsating currents may be produced in the anode circuit of a discharging valve, by means of a relay the coil of which is inserted in the anode circuit of the valve, and which alternately charges and discharges a condenser inserted in the inlet circuit of the valve.

The anode circuit of the valve may contain potentiometers from which the voltages for controlling the time interval and the amplitude of the impulses are taken. In order to be able to reduce arbitrarily to zero the minimum value of the current through the potentiometers, without the relay being prevented from operating, a portion of the circuit containing the relay coil, the valve and the potentiometers may be shunted with a variable resistance.

In order to change the shape of the pulsating current, means may be found for altering the charging current and the discharging current of the condenser independently of each other.

The impulses may be produced by means of a condenser, by charging or discharging the same by way of a discharging bulb of the kind having an igniting voltage that is higher than the extinguishing voltage, and by charging or discharging the condenser by way of a discharging valve the grid voltage of which is controlled by the rhythmically pulsating current, the time interval between the impulses being thus altered in accordance with the said current. The minimum time interval between the impulses may be modified by altering a grid bias imposed on the valve. The discharging bulb may preferably be a glim lamp.

The adjustment of the amplitude of the impulses may be effected by an amplifier valve in which the impulses are amplified, and on the grid voltage of which the rhythmically pulsating current is superimposed, in such a manner that the impulse amplitude varies in accordance with the latter. The minimum amplitude of the impulses may be varied by varying a grid bias imposed on the said valve.

The invention is further explained in the following, reference being made to the drawing in which:

Fig. 1 shows a wiring diagram for one con-

struction of an apparatus according to the invention,

Fig. 2 the voltage curves for a series of impulses produced by means of the apparatus shown in Fig. 1, and

Fig. 3 the voltage curves for two individual impulses.

The apparatus shown in Fig. 1 consists of three parts, viz. one part for producing the rhythmically pulsating current, one part for producing the impulses and for controlling the mutual time interval between the latter, and one portion for controlling the amplitude of the impulses.

The rhythmically pulsating current is produced by means of a triode valve 1 the anode 2 of which is connected, by way of a relay coil 3 for a relay 4, to the positive terminal 5 of a source of voltage. The cathode 7 in the valve 1 is connected to the negative terminal 6 of the source of voltage by way of two parallel current paths, viz. partly by way of a potentiometer 8 with a sliding contact 9, and partly by way of a series connection consisting of a resistance 10 and a potentiometer 11 with a sliding contact 12. The two current paths may be alike, and are merely shown different in order to indicate that each current path may either consist merely of a potentiometer or of a potentiometer connected in series with a fixed resistance. The two potentiometers may further be replaced by one single potentiometer having two sliding contacts adapted to be adjusted independently of each other. Across a resistance 14 the armature of the relay 4 is connected to the grid 13 of the valve 1, which grid is further connected to the cathode 7 by way of a resistance 15 and a condenser 16. A battery 17, the positive and negative terminals of which are marked 18 and 19 respectively, has two outlets 20 and 21, the voltage being more positive at the outlet 20 than at the outlet 21. The outlet 20 is connected to the cathode 7. The positive terminal 18 of the battery is connected, by way of a potentiometer 22 with a sliding contact 23 and, by way of a resistance 24, to the outlet 21 which by way of a resistance 25 and a potentiometer 26 with a sliding contact 27 is connected to the negative terminal 19 of the battery. The sliding contacts 23 and 27 are connected, respectively, to a circuit-breaking contact 28 and a circuit-closing contact 29 in the relay 4.

When the current in the relay coil 3 alternately assumes various values, the armature 13′ will alternately close a contact with the contacts 28 and 29. At the moment when a contact is closed for instance between the armature 13′ and the contact 28, the current in the relay coil will be relatively small. Across the potentiometer 22, the sliding contact 23, the contact 28 and the resistance 14, the grid 13 will receive a voltage that is higher than the voltage imparted subsequently thereto by way of the potentiometer 26, the sliding contact 27 and the contact 29, when the armature 13′ is attracted. The grid 13, however, does not at once receive the voltage possessed by the sliding contact 23, as the condenser 16 must first be charged by way of the resistances 14 and 15 which limit the current. Gradually, as the condenser is charged and, consequently, the voltage of the grid 13 is increased, the current through the relay coil 3 will be augmented until the said coil attracts the armature 13′ which subsequently closes a contact with the contact 29. Thus a negative voltage is imparted to the condenser 16, and the grid 13 becomes more negative, gradually as the condenser 16 is discharged, and becomes charged with a negative voltage on the grid side. When the grid voltage and, consequently the current through the relay coil 3 has dropped to a certain value, the armature 13′ recedes, and closes again a contact with the contact 28 causing the condenser 16 to be charged again with a positive voltage on the grid side. By the chargings and dischargings of the condenser 16 produced in this manner, a rhythmically pulsating current is produced in the anode circuit of the valve 1, and corresponding voltages will occur on the potentiometers 8 and 11. The form of these voltages may be varied by varying the magnitude of one or more of the coupling elements in the circuits having connection to the grid 13. When these values have been fixed, the time required by the voltage for rising and for dropping may be varied, independently of each other, by means of the sliding contacts 23 and 27. If for instance the sliding contact 23 is approached to the positive end of the potentiometer 22, the voltage difference between the cathode 7 and the sliding contact 23 will increase. The condenser 15 will consequently be charged more quickly, and the anode current of the valve will increase more quickly.

By the arrangement described heretofore the current through the potentiometers 8 and 11 does not vary down to the minimum limit zero. In order to attain this result, there is provided, between the anode 2 and the negative terminal 6 of the source of voltage, a variable resistance 30 serving to shunt the series connection of the valve 1 and the potentiometers 8 and 11 inserted in parallel. The resistance 30 is adjusted in such a manner that the current through the valve 1 and the potentiometers 8 and 11 will approach zero as closely as desired, when the current in the relay coil 3 has dropped to its minimum value at which the relay armature 13′ recedes. The varying current through the relay coil 3 will not be altered in consequence hereof.

Every point of the potentiometer 22 has a voltage that is higher than the voltage required in order that the current passing through the relay coil 3 may be sufficiently intense to cause the coil to attract the armature 13′, and every point of the potentiometer 26 has a voltage that is lower that the voltage required in order that the current through the relay coil 3 may be so small that the armature 13′ recedes.

The portion of the apparatus in which the impulses controlled by the rhythmically pulsating current are produced, and in which the mutual time interval of the impulses is adjusted, contains a pentode valve 31 the controlling grid 32 of which is connected, by way of a filter chain consisting of two resistances 33 and 34 and a condenser 35, to the sliding contact 12 on the potentiometer 11. The valve 31 has further an anode 36, an intercepting grid 37, a shielding grid 38 and a cathode 39. The intercepting grid 37 is connected to the cathode 39. The shielding grid 38 receives a positive voltage by way of a sliding contact 40 on a potentiometer 41 inserted between the terminals 5 and 6 of the source of voltage. A condenser 42 is provided between the shielding grid 38 and the negative terminal 6. By way of a glim lamp 43, the anode 36 is connected to the positive terminal 5 and, by way of a condenser 44, to the negative terminal 6. The cathode 39 is connected to a sliding contact 45 on a potentiometer 46 which is inserted in a resistance chain containing further the resistances 47 and 48, and being connected by way of the terminals 5 and 6 of the source of voltage. The cathode 39 is

coupled to the negative terminal 6 by means of a condenser 49.

The valve 31 acts as a variable resistance disposed as a shunt across the condenser 44. When the condenser is charged by way of the glim lamp 43, the latter is extinguished, and the condenser 44 is discharged by way of the valve 31, until the voltage over the condenser has become so low that the glim lamp 43 is ignited again, and charges the condenser 44, etc. An impulse is produced at each charging and subsequent discharging of the condenser 44.

The voltage impulses occurring by way of the condenser 44 have a duration that is mainly equal to the time interval between the individual impulses. The voltage rises quickly and in a rectilinear manner to a certain value, and drops then relatively slowly to a certain lower value, after which it rises quickly again, etc. The voltage curve for the condenser 44 assumes consequently a toothed appearance, each tooth corresponding to one single impulse. The shape of the impulses, however, is changed during their further passage through the apparatus, as further described in the following.

The time interval between the impulses may be modified by altering the resistance in the valve 31. This resistance is depending on the voltage of the grid 32 in comparison with the cathode 39. If the grid voltage rises, the resistance in the valve 31 is reduced and, consequently, the time interval between the impulses becomes shorter. The grid voltage and, consequently, the time interval between the impulses are controlled by the voltage of the sliding contact 12 relatively to the cathode 39, and this voltage is determined partly by the rhythmically pulsating current passing through the potentiometer 11 and partly by the dorp of voltage across the resistance that is inserted between the sliding contact 45 and the negative terminal 6 of the source of voltage. This drop of voltage may be regulated by means of the sliding contact 45, the position of which determines the maximum time interval between the impulses. By means of the sliding contact 12, the range of variations for the time interval is adjusted. Gradually as the sliding contact 12 is approached to the negative end of the potentiometer 11, the range of variations for the time interval becomes smaller and smaller, and finally a constant time interval between the impulses is reached which is determined by the position of the sliding contact 45.

When the maximum time interval for the impulses is altered, the minimum time interval will be altered at the same time, provided that the range of variations remains the same. In order to be able to alter the maximum time interval, without altering the minimum time interval, the range of variations for the time interval must be altered correspondingly. This may be done for instance by inserting, between the sliding contact 12 and the negative terminal of the source of voltage, a variable resistance which is dimensioned in such a manner, and the controlling shaft of which is coupled mechanically to the controlling shaft of the potentiometer 46 in such a manner that a change in the maximum time interval will not influence the minimum time interval, but will solely influence the range of variations. Such a variable resistance is not shown on the drawing.

The maximum time interval is further dependent on the position of the sliding contact 40 on the potentiometer 41, in such a manner that by approaching this contact to the positive end of the potentiometer the time interval between the impulses may be reduced, independently of the grid bias for the valve 31.

The voltage variations produced on the condenser 44 are directed, by way of a coupling condenser 50, to the last part of the apparatus in which the amplitude of the impulses is controlled. This part contains an amplifier valve 51 in the shape of a pentode with a cathode 52, a controlling grid 53, a shielding grid 54, an intercepting grid 55 and an anode 56. The impulses are directed from the coupling condenser 50 to the controlling grid 53. The anode 56 receives a positive voltage by way of a choking coil 57. The intercepting grid 55 is connected to the cathode 52. The shielding grid 54 receives positive voltage by way of a resistance 58, and is coupled to the negative terminal 6 of the source of voltage, by means of a condenser 59. The cathode 52 is connected to the negative terminal 6 by way of a variable resistance 60 which is shunted with a condenser.

The voltage taken from the potentiometer 8 by means of the sliding contact 9 is directed to the grid 53 by way of a filter chain consisting of two resistances 62 and 63 and a condenser 64, in such a manner that the constant grid bias determined by the magnitude of the variable resistance 60 is superimposed with the voltage determined by the rhythmically pulsating current passing through the potentiometer, by way of the lower part of the potentiometer 8 determined by the position of the sliding contact 9. The amplification produced in the valve 51 is varied in time with the rhythmically pulsating current. The amplified impulses are delivered from a terminal 65 which is connected to the anode 56 by way of a condenser 66, and a terminal 67 which is connected to the negative terminal 6 of the source of voltage. The range of amplification variations for the impulses may be adjusted by means of the sliding contact 9 on the potentiometer 8, and is varied from zero and upward, while the minimum amplitude may be adjusted by means of the variable resistance 60.

The magnitude of the impulses directed on to the grid 53 may be limited by means of a variable resistance 68, one end of which is connected to the grid 53, and the other end of which is connected to the negative terminal 6, by way of a condenser 69. When the resistance 68 is reduced, the impulses will be reduced.

As mentioned above, the shape of each individual impulses is altered during the passage through the apparatus. The curve of voltage for the voltages occurring on the condenser 44 has a toothed appearance, each tooth corresponding to one single impulse. When the impulses have passed the condenser 50, which for instance may be about 100 cm, their voltage curve has about the shape of a triangle with a relatively short base, and the duration of the impulses is consequently smaller than the time interval between two successive impulses. In consequence of the impedances contained in the outlet circuit of the valve 51, the impulses become dipolar, and assume the shape shown in Fig. 3.

In the construction shown of the apparatus, the time interval and amplitude of the impulses vary in such a manner that the maximum amplitude occurs simultaneously with the minimum time interval, and the minimum amplitude occurs simultaneously with the maximum time interval. Fig. 2 shows such a series of impulses 70, the

voltage on the outlet terminals of the apparatus being plotted as a function of the time. The finely drawn lines 71 and 72 through the voltage maxima and minima, respectively, of the individual impulses do not indicate the voltages occurring at the outlet terminals of the apparatus, but are merely enveloping curves for the series of impulses, and they illustrate the rhythmically pulsating variation of the impulse amplitude. The portion of the enveloping curves for which the impulse amplitude is increasing and decreasing are called, respectively, the wave rise and the wave drop. By the selection of various amplifier valves, and by a suitable selection of the coupling elements contained in the inlet circuit of the valve 1, and by the introduction of capacities, resistances and self inductions in the grid circuit for the valve 51, the shape of the wave rise and the wave drop may be adjusted as desired. Analogously, the modification of the time interval between successive impulses at various points of the enveloping curves may be adjusted as desired. The difference in height between the maxima and minima of the enveloping curves indicates the range of amplitude variation, and the minima of the enveloping curves indicate the minimum amplitude. The corresponding time interval between the impulses is the maximum time interval which may be adjusted to any desired value by means of the sliding contact 40, and may be altered inside of any desired range by means of the sliding contact 45. The minimum time interval occurs in the maxima of the enveloping curves, and the difference between the latter and the maximum time interval is the variation range which may be modified by the sliding contact 12, and has the lower limit zero, independently of the maximum time interval.

The time passing between two wave summits of the enveloping curve may be varied by means of the sliding contacts 23 and 27. A change in this range of variations may be effected by altering the magnitudes of the coupling elements entering in the grid circuit for the valve 1, or by the addition of further coupling elements. The charging of the condenser 16 may also be effected by means of one valve more instead of the battery shown, or by means of a mechanically driven sliding contact which alters the voltage of the grid 13.

Instead of the triode valve 1, there may be used a valve with more grids, any one of which may be used as a controlling grid. A combination grid may also be used having such a number of electrodes that both the production of the rhythmically pulsation current and the amplitude variation or the variation of the time interval between the individual impulses may be effected in the same valve.

The coupling between the valves 31 and 51 may be altered in such a manner that the impulses are directed from both sides of the glim lamp 43 to cathode 52 and the grid 53, respectively, by means of suitable coupling elements.

The bulb 43 may be a glim lamp or other known discharging valve, the ignition voltage of which is higher than the extinguishing voltage, for instance a so-called gas triode. In order to gain stability, the condenser 44 is coupled to the negative terminal 6 of the source of voltage, but it may also be disposed in parallel to the discharging bulb 43. When a glim lamp is used, the individual impulses occur with the shape shown in Fig. 3, at the outlet terminals of the apparatus. The Figure shows the voltage variation for two successive impulses 73 and 74. The oscillations are dipolar, and the two halves of each impulse variation may be rendered more or less symmetrical by the insertion of impedances in the circuits in which the glim lamp is inserted. The duration and the time interval of the impulses are marked *t* and T, respectively.

The amplifier valve 51 and its coupling may be varied, the impulses, however, being constantly delivered to one of the grids of amplifier valve. The ratios between the shown combinations of fixed resistances and potentiometers should preferably be selected in such a manner that the desired variation will be attained by a full rotation of the controlling shafts of the potentiometers.

The time interval T between the impulses varies mainly between 10 seconds and $\frac{1}{50}$ of a second. The amplitude varies between zero and about 20 volts.

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PUBLISHED
MAY 25, 1943.
BY A. P. C.

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BY MEANS OF ELECTRIC IMPULSES
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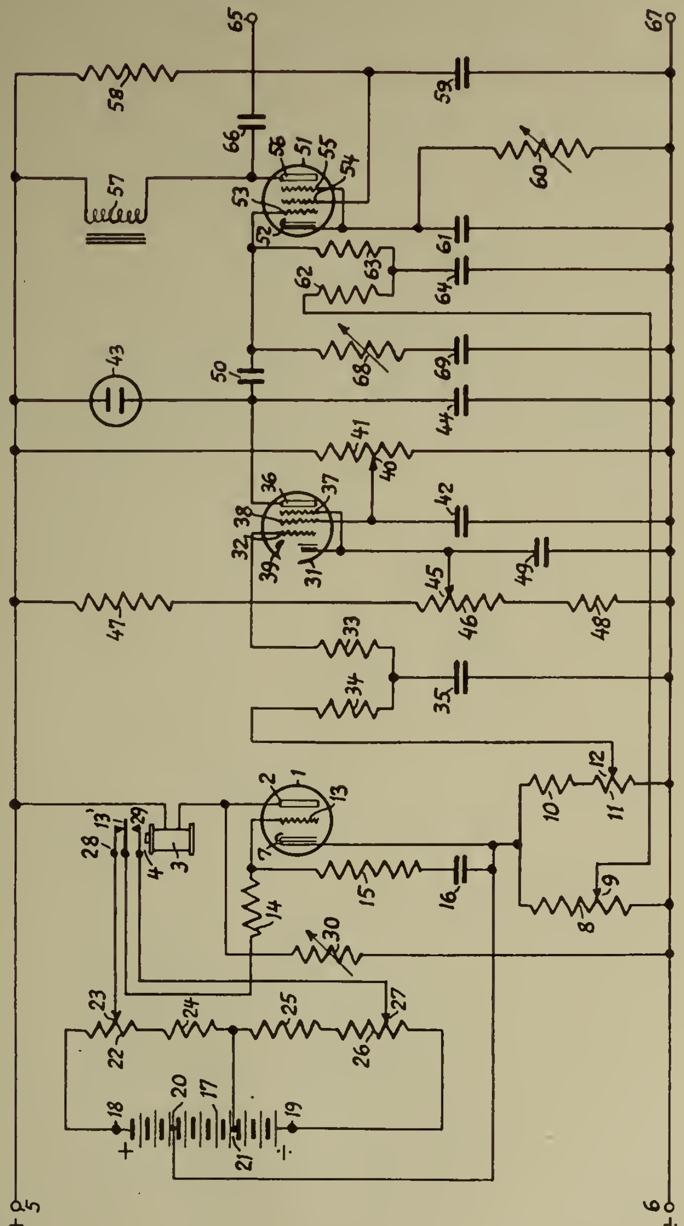

Fig. 1.

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Fig. 2.

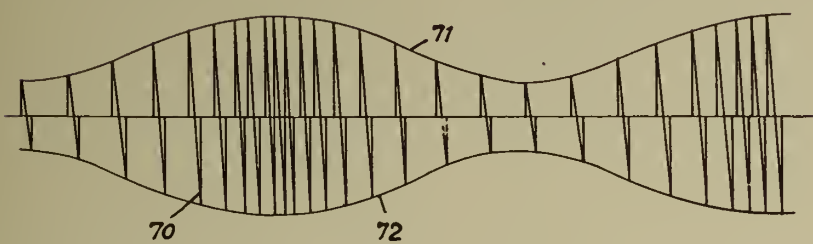
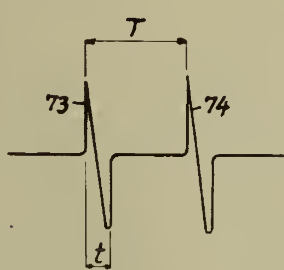


Fig. 3.



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APPARATUS FOR TREATMENT OF NERVES AND MUSCLES BY MEANS OF ELECTRIC IMPULSES

Preben Morland, Gentofte, and Jorgen Adolph Smith, Copenhagen, Denmark; vested in the Alien Property Custodian

Application filed September 3, 1941

The invention relates to an apparatus for treatment of nerves and muscles with electric impulses, especially for artificial innervation of muscles, for instance for therapeutic and diagnostic purposes.

In such apparatuses it is known to use electric impulses the voltage curve of which is monopolar or dipolar, cf. the explanation given in the specification of American Patent No. ______ (Serial No. ______). The dipolar curve which consists of a portion situated on one side of the voltage of repose and a corresponding part that is situated on the other side of this voltage is the most frequently used curve, and may relatively simply be produced in a form in which the duration of the impulse, especially the duration of the first part of the impulse, which is of the greatest importance to the treatment, is very short. In the known apparatuses it is usual that the individual impulses are emitted automatically in succession, with a mutual time interval that is greater than the duration, of each individual impulse. It is also known to arrange the apparatuses in such a manner that the time interval between the impulses and the amplitude of the same is varied periodically and automatically, at a relatively slow rhythm.

The present invention relates to an improvement in apparatuses of the said nature, whether the same are arranged for a monopolar or a dipolar curve shape, for the emission of individual impulses or a series of such, or for constant time interval and amplitude, or for a periodical variation of one or the other, or both, of these features.

The invention is based on certain observations concerning the chronaxialty of muscles actuated by an electric current. The chronaxialty is a measure of the inertia of reaction of a muscle, which is the time passed from the beginning of an electric treatment to the reaction of the muscle, at a certain electric voltage which according to the investigator Lapicque is assumed to be twice the voltage (the rheobase) that is just sufficient to produce a reaction in the muscle. Roughly spoken, the inertia of reaction varies with the acting voltage in such a manner that the product of the voltage and the inertia of reaction at this voltage is constant. For this reason it is not necessary, as proposed by Lapicque, in the examination of the state of a muscle to use a certain voltage, but simply the said product may be used as a measure, as long as certain limits for the magnitude of the voltage are not exceeded. Assuming the voltage to be maintained constant during the measuring, the measure for the state of the muscle, in respect to the inertia of reaction, will be equal to the area of a rectangular voltage impulse that is just able to cause the muscle to react. It is, however, not necessary to use a rectangular impulse. Even if the impulse is rounded at the top, and its width decreases upward, it can be used in the measuring. We have thus a simple means for performing the said measurements.

The above mentioned known apparatuses for treatment of nerves and muscles with electric impulses are not suited for performing the measurements referred to here. It is certainly feasible by these apparatuses to alter the amplitude of the impulses and, consequently, the area of the impulses, but this is done by a short constant duration of the impulses for which reason it is impossible to attain sufficiently large areas, without the maximum value of the voltage becoming too high. This drawback of the apparatuses, however, may be removed according to the invention, if the apparatuses are arranged in such a manner that the area of the impulse curve may be altered by varying the duration of the impulses.

In this manner we attain not only an apparatus for diagnostic use, but the apparatus may also be used in the electric nerve and muscle therepeutics. Experience has shown, for instance, that diseased muscles will only react when the impulse curve has a relatively large area. In the treatment of such muscles it is preferable to start the treatment with impulse curves with this area and, gradually as the treatment proceeds, to reduce the area. A reaction will then constantly be attained, at decreasing areas, until finally the area is attained, or passed beyond, that a healthy nerve would transmit to the muscle concerned.

In the use of the apparatus for training of muscles, the same is adjusted for emitting series of impulses, the amplitude and time interval of the impulses being either maintained constant or caused to vary periodically, as mentioned above. Monopolar as well as dipolar impulses may be used. In the case of the latter, the last part of the impulses, the polarity of which is opposite that of the first part, will sometimes not come into operation, viz. if the refraction time of the muscle, i. e. the time passing from one actuation to the moment when the muscle can again react for an actuation, exceeds the duration of the impulses. In certain muscles and for certain arrangements of the current-supplying electrodes, the two parts of the impulses may be caused to act on various parts of the muscle, in such a manner that both impulse parts become useful.

In the apparatus according to the invention, not only the area of the impulse curve will be altered, but also its shape. As it is desirable, out of respect to the state of the nerves and muscles and the nature of the treatment, to be able to make further changes in the shape of the impulse curves, means are further provided for removal of certain parts of the voltage curve of the impulses, in such a manner that in each individual case the form of impulse may be attained that is most suitable for the special purpose for which the impulse is desired to be used.

The apparatus according to the invention is thus mainly characterized by means for altering the shape and area of the impulse curve by altering the duration of the impulses, and by means serving to remove certain parts of the voltage curve.

The apparatus may be constructed in such a manner that the impulse voltage is produced by charging or discharging of a capacity by way of a discharging valve, for instance a glim lamp, the ignition voltage of which is higher than its extinction voltage, and by discharging or charging the capacity by way of a discharging valve. In such an apparatus, the capacity according to the invention is rendered variable or adjustable, in order to alter the duration of the impulses. For the same purpose, the circuit of the discharging valve may contain a variable or adjustable inductance or resistance or both.

The apparatus may further be constructed in such a manner that the impulses are amplified by an amplifier valve by which a periodically varying modification of the amplitude of the impulses may also be produced. In such a construction of the apparatus, the latter is fitted according to the invention with means for altering of a grid bias on the amplifier valve, in order to compensate the amplitude variation contingent on a modification of the duration the impulses. The apparatus may further be fitted with means for altering a grid bias on the discharging valve by way of which the capacity is discharged or charged, in order to compensate the variation in the impulse interval contingent on the change in the duration of the impulses. According to the invention it is preferable to provide a common adjusting member for the means by which the grid bias on the amplifier valve or x the discharging valve, or both, x is altered, and for the adjustable or variable capacity or inductance or both, it being frequently desired to use the apparatus in such a manner that the area of the impulse curve is altered, without the simultaneous alteration of the impulse amplitude and the time interval between the impulses.

The means for removing certain parts of the impulse curve comprise preferably a rectifier arranged for complete or partial removal of the impulse voltages that exceed a certain constant or rhythmically pulsating positive voltage. The said means may further comprise a rectifier constructed for complete or partial removal of the impulse voltages that are lower than a certain constant or rhythmically pulsating negative voltage.

One, or both, of the said rectifiers have preferably means for adjustment of the rectifier effect to values between complete rectification and the rectification effect zero.

If the given impulses are dipolar, the first mentioned means may comprise a rectifier arranged for complete or partial rectification of either the positive or the negative part of the impulse voltage, for instance for attaining monopolar impulses or for improving the symmetry of the individual impulses.

The said means or one or more of the rectifiers may be connected to a special winding on an outlet transformer which is provided in the apparatus, and from the secondary winding of which the impulses altered by the arrangement according to the invention are taken.

The invention is further explained in the following, with reference to the drawing, in which

Fig. 1 shows a wiring diagram for a construction of the portion of the apparatus according to the invention in which the impulses are generated, and which contains means for varying their duration and time interval.

Figs. 2, 3 and 4 various forms of voltage curves produced by various adjustments of the part of the appartus that is shown in Fig. 1.

Fig. 5 a diagram of a construction of the part of the apparatus according to the invention that makes it feasible to remove certain parts of the voltage curve.

Figs. 6, 7, 8 and 9 show examples of voltage curves for one single impulse, gradually as the latter passes through the part of the apparatus shown in Fig. 5.

Fig. 10 an apparatus for controlling the device shown in Fig. 5, and

Figs. 11, 12 and 13 various manners of connection for the arrangement shown in Fig. 5.

The apparatus shown in Fig. 1 consists of one part for the generation of impulses and for the control of their mutual time interval, and one part for control of the amplitude of the impulses. The apparatus may further contain a part for producing a periodical variation of the time interval or the impulse amplitude or both. The last mentioned part of the apparatus which is not shown on the drawing may for instance be arranged as described and shown in the specification of Danish Patent No. ——— (appl. register 1940, No. 1,154, Case A) and the drawing belonging thereto.

Across the primary winding **11** of a transformer **12**, a glim lamp **10** is connected to the positive terminal **13** of a source of voltage and, across an adjustable condenser **14**, to the negative terminal **15** of the source of voltage. A pentode valve **16** is disposed as a variable shunt over the condenser **14**, the plates of the condenser being connected to the cathode **17** and the anode **18** in the valve. The controlling grid **19** of the valve is connected to a clamp **20** by way of which a rhythmically pulsating voltage may be supplied, if desired. The shielding grid **21** of the valve receives a suitable positive voltage in that it is connected to a point between a fixed resistance **22** and a variable resistance **23** inserted in series, between the clamps **13** and **15**. The shielding grid **21** is further coupled to the cathode **17** by way of a condenser **24**. The intercepting grid **25** of the valve is connected to the cathode **17**. The resistance in the valve **16** may be adjusted to various values by an adjustment of the sliding contact **26** of the resistance **23**.

The secondary winding **27** of the transformer **12** is connected to a variable resistance **28** by means of which it is feasible to adjust the value of the inductance produced by the transformer **12**, in the circuit of the glim lamp **10**.

In the construction described, the condenser **14** will alternately be charged by way of the glim lamp **10** and discharged by way of the pentode valve **16**. The varying voltage thus produced on

the condenser 14 is directed across an adjustable condenser 29 to the controlling grid 30 of an amplifier valve in the form of a pentode valve 31. In other respects this valve is connected in a similar manner as the valve 16, with the exception that its anode circuit contains an inductance 32 which is variable, in that it is shunted with an adjustable resistance 33. The shielding-grid resistance is determined by adjustment of a sliding contact 34.

The outlet voltage of the apparatus is delivered by way of the clamps 35 and 36, the former one of which is connected to the anode of the valve 31 by way of a condenser 37, while the latter is connected to the cathode of the said valve.

If the inductance produced by the transformer 12 in the circuit of the valve 10 is small, short impulses of the shape shown in Fig. 2 will occur at the clamps 35 and 36, the duration t of the impulses being dependent on the said inductance and the capacity of the condenser 14. The time interval T between the impulses depends on the resistance in the valve 16, and the amplitude of the impulses depends on the amplification produced in the valve 31. The time interval may consequently be adjusted by an adjustment of the sliding contact 26, and the amplitude by adjustment of the sliding contact 34.

If an impulse curve is desired with a greater duration $t°$, as shown in Fig. 3, this result may be attained by increasing the inductance produced by the transformer 12, or by increasing the capacity of the condenser 14. At the same time a change will be effected in the time interval and the amplitude of the impulses. The time interval may be reduced to its former value by an adjustment of the sliding contact 26. The impulse amplitude may be reduced to its former value by an adjustment of the sliding contact 34, or of the resistance 33, or of both of these members simultaneously. The maintenance of a constant time interval and a constant amplitude for the impulses may be attained automatically, in that the various members 26, 12, 14, 34 and 33 are coupled to one common adjusting member.

Fig. 4 shows impulses the voltage curve of which is composed of rectilinear parts. Figs. 3 and 4 form the extreme cases for the shape of the impulse curves, the character of which varies within the said curves with the magnitude of the impedances, inductances or capacitances. By the use of special valves, also concave voltage curves may be attained.

If the apparatus is to operate with periodic variation of the time interval between the impulses and of the impulse amplitude, this result may be attained by supplying a rhythmically pulsating voltage to the clamp 29 that is connected to the controlling grid 19 in the valve 16 and to a clamp 38 connected to the controlling grid 30 in the valve 31. This voltage may for instance be produced by the means disclosed in the specification of Danish Patent No._____ (App. register 1940 No. 1154, Case A).

The apparatus described may be altered in various manners, without the scope of the invention being transgressed. The discharging valve will thus not necessarily have to be a glim lamp, but may be a so-called gas triode. The condenser 14, instead of entering in series with the discharging valve, may be placed in parallel with the same, in such a manner that the condenser is not charged but discharged by way of the lamp. Further, inductances 39 and 40 of various magnitude may be inserted in connection with the transformer 12, or instead of the same, as shown in Fig. 1, the said inductances being inserted singly by means of a throw-over switch 41. These are merely a few examples out of a large number of possible modifications.

It should be noted that an adjustment of the condenser 29 will also affect the duration of the impulses, in such a manner that this condenser may be used as a means of adjustment, either alone or in combination with the adjusting means inserted in the circuit of the discharging lamp.

In the construction shown in Fig. 5, the impulses are supplied by way of two inlet clamps 101 and 102 connected, by way of condensers 103 and 104, respectively, to two conductors 105 and 106, respectively, the other ends of which are connected to outlet clamps 107 and 108, respectively. As far as direct current is concerned, the condensers 103 and 104 serve to separate the device from the apparatus to which the inlet clamps 101 and 102 are connected, and in which the impulses are produced. The latter may have the shape shown in Fig. 6. The impulse is dipolar, and consists of a positive part 109 and a negative part 110. Between the conductors 105 and 106, a rectifier is inserted which consists of a rectifier valve 111, the anode 112 of which is connected to the conductor 105 by way of a variable resistance 113 and a condenser 114, and the cathode 115 of which is connected to the conductor 106 by way of two condensers 116 and 117 disposed in series. The condenser 116 is shunted with a portion of a potentiometer 118, the binding posts of the said condenser being connected, respectively, to one end of the potentiometer 118 and a sliding contact 119 on the same. The effect of the rectifier is, as follows:

The potentiometer 118 is assumed to be connected to a source of voltage in such a manner that the free end of the potentiometer 118 has a positive potential, relatively to the other end of the same. The sliding contact 119 has consequently a potential that is situated between the values of the potentials impressed on the ends of the potentiometer 118. The condenser 116 is charged from the potentiometer to a voltage that is determined by the position of the sliding contact 119. Between the conductors 105 and 106 there is normally no potential difference, but whenever an impulse passes the conductor 105 the following happens: At low positive voltage values the anode 112 will not yet be positive, relatively to the cathode 115, and it will therefore repel the electrons emitted from the latter. At the moment when the impulse voltage has been raised to such a value that the potential of the anode 112 becomes zero, relatively to the cathode 115, the rectification will commence. This rectification is not complete, i. e. it depends on the resistance that is inserted in the circuit, i. e. mainly on the magnitude of the resistance 113. If the latter is gradually reduced, the rectification will be more and more perfect. After the impulse running along the conductor 105 has passed the parallel connection formed by the rectifier, it will have the shape shown in Fig. 7. The curve drawn with full lines corresponds to the variable resistance 113 being cut off entirely, while the finely drawn curve parts 120 and 121 correspond to a portion of the said resistance being inserted, in such a manner that only a partial rectification is effected. The horizontal line 122 limiting the curve in the direction upward corresponds to a complete rectification above the limit concerned. At any voltage lower than the one determined by the line

122, the anode 112 is negative, relatively to the cathode 115, and the rectifier has therefore no influence on the shape of the curve.

Between the conductors 105 and 106, another rectifier is inserted which has for its object to cut off the top of the negative portion 110 of the impulse. This rectifier is arranged in the same manner as the one described above. The reference numerals for the individual parts of the rectifier are fitted with index marks ('), but correspond otherwise to the numerals used in the rectifier described above. The only difference between the two rectifiers consists in that they are disposed with opposite polarities, relatively to the conductors 105 and 106.

The rectifier containing the rectifier valve 115' has the same effect on the negative part of the impulse running along the conductor 105, as has the rectifier containing the rectifier valve 115, as described above, on the positive part of the same impulse. When the impulse running along the conductor 105 has moved past the parallel connection formed by the rectifier containing the rectifier valve 115', it will have the shape shown in Fig. 8, provided that the resistance 113' has been cut out, which corresponds to a complete rectification below the limit concerned. The lower part of the negative portion of the impulse curve is cut off along the straight line 120', and the position of the said line is determined by the position of the sliding contact 119' on the potentiometer 118' which is connected to a source of voltage. The variable resistance 113' has such a magnitude that the rectifier has no effect on the shape of the impulse curve, when the resistance is inserted with its full size. The same applies to the resistance 113 and the rectifier belonging thereto.

Finally, a rectifier is inserted between the conductors 105 and 106, and it consists of a double rectifier valve 132 with two anodes 133 and 134 and two cathodes 135 and 136 which are both connected to a sliding contact 137 on a potentiometer 138 inserted between the conductors 105 and 106. The anodes 133 and 134 are connected each to one end of the potentiometer 138.

When the sliding contact 137 is at the end of the potentiometer 138 that is connected to the conductor 106, the rectifier valve 132 will cause a rectification of the positive part of an impulse running along the conductor 105, the anode 133 being in that case positive, relatively to the cathodes 135 and 136. If the sliding contact 137 is at the end of the potentiometer 138 that is connected to the conductor 105, the rectifier valve 132 will cause a rectification of the negative part of an impulse running along the conductor 105, the anode 134 being in that case positive, relatively to the cathodes 135 and 136. In the last mentioned case, the impulse running along the conductor 105 has the shape shown in Fig. 9. The impulse 123 shown here is rectangular, or mainly rectangular, and monopolar. By means of the sliding contact 137, the rectifying effect on the two impulse parts may be adjusted. The potentiometer 138 is of such a size that it does not act as any appreciable loading for the impulse voltages occurring on its binding posts. By means of this last described rectifier the symmetry of the two parts of the impulse curve may be improved, or the positive or the negative part of the impulse curve may be removed completely.

Impulses with the desired curve shape may be delivered at the outlet clamps 107 and 108. The invention is not limited to the shape of impulses shown in Fig. 6, although this is the form of impulses that is mainly used.

The impulses are generally emitted automatically in succession with a mutual time interval that is longer than the duration of each individual impulse. The apparatus for producing the impulses may further be constructed in such a manner that the time interval between, and the amplitude of, the impulses is automatically varied periodically, at the relatively slow cadence. In that case, corresponding parts of the individual impulse curves are preferably cut off. This may be effected, instead of by placing a constant voltage on the potentiometers 118 and 118', by impressing on the same a voltage varying in the same manner as the time interval between the individual impulses and/or the amplitude of the same. In this manner a series of impulses on the clamps 107 and 108 will be attained, the curve shapes of the same being similar and depending on the position of the sliding contacts 119 and 119'.

In the arrangement shown in Fig. 5, three rectifiers with special couplings are used, but the number of rectifiers may be varied as desired, and the individual couplings may be modified in a suitable manner, when special curve shapes are desired, or other curve shapes than those shown on the drawing.

Fig. 10 shows an apparatus for producing the controlling voltages impressed, as mentioned above, on the potentiometers 118 and 118', when the time intervals and amplitude of the impulses vary automatically. The apparatus contains a pentode valve 140 with an anode 141, an intercepting grid 142, a shielding grid 143, a controlling grid 144 and a cathode 145. The anode 141 receives a positive voltage by way of a resistance 146 connected to a binding post 147 which in its turn is connected to the positive terminal of a source of voltage, the negative terminal of which is connected to a binding post 148. The intercepting grid 142 is connected to the cathode 145. The shielding grid 143 receives a positive voltage across a resistance 149, and is coupled to the binding post 148 by way of a condenser 150. Between the shielding grid 143 and the binding post 148, a resistance 151 is further inserted. Across four potentiometers, the cathode 145 is connected to the binding post 148. Two of these potentiometers are the potentiometers 118 and 118' shown in Fig. 5 with sliding contacts 119 and 119', respectively. The other potentiometers 128 and 152 having the sliding contacts 129 and 153, respectively, may be used, provided that the arrangement shown in Fig. 5 contains still two rectifier circuits to be controlled in the above mentioned manner. The potentiometers 118 and 118', 128 and 152 are shunted with a condenser 154. The grid 144 receives a voltage varying in the same manner as the time interval and amplitude of the impulses. Between the anode 141 and the binding post 148, a variable resistance 155 is disposed, which is adjusted in such a manner that the valve 140 is currentless, when the voltage impressed on the grid 144 has its minimum value.

Figs. 11, 12 and 13 show various manners of connection for the arrangement shown in Fig. 5. Fig. 11 shows an outlet transformer in the apparatus for producing the electric impulses. The primary winding of the transformer is marked 156. The impulses are delivered by way of a secondary winding 157. The device is connected to a

special winding 158 on the transformer. The winding 158 acts as a short-circuit for the not desired parts of the impulse curve, while the winding 157 acts as a generator for impulses with the desired curve shape. In this manner a reliable separation, as far as direct current is concerned, is attained between the outlet circuit of the impulses from the other parts of the apparatus. The device, however, may also be connected in parallel to the primary winding of an ordinary outlet transformer in the part of the apparatus that serves to generate the impulses, the latter being delivered by way of the secondary winding of the transformer.

Fig. 12 shows a choking coil 159 inserted in the outlet circuit of the apparatus for generating the impulses. The inlet clamps 101 and 102 for the device shown in Fig. 5 are connected each to one end of the choking coil 159.

Fig. 13 shows a resistance 160 inserted in the outlet circuit of the apparatus, by way of which resistance the device shown in Fig. 5 is connected. In the two latter cases, the desired impulses are delivered by way of the outlet clamps 107 and 108 of the device.

If the outlet circuit of the apparatus is resistance-coupled, as shown in Fig. 13, the device may be inserted at another point that is situated nearer to the inlet circuit for the amplifier situated in front thereof.

Instead of the potentiometers 118 and 118′ in connection with the condensers 116 and 116′, respectively, batteries of suitable sizes may be inserted between the cathodes 115 and 115′, respectively, and the condensers 117 and 117′, respectively.

The arrangement according to the invention may be modified in many manners, without the scope of the invention being exceeded. There may thus be generated impulses with pointed curve shapes and impulses the curve area of which is sections of given impulse curves.

The pointed curve shape, the lower part of which may be cut off may be used for treatment of healthy muscles, in order to prevent the same from degenerating, in the case of the corresponding nerve or nerves being temporarily or for a longer period set out of function. Sectional curves are used as measuring curves and, mainly, in single impulses, for the so-called chronaxialty measurements, but they may also be used in series and with adjustable time interval for determination of the refractory period of muscles. The sectional curves may further be used for sensitive actuation for measurement of sensibility disturbances and for actuation of cordial muscles. Pointed curves and curves with a great duration are used for training of muscles, all depending on the physiological state of the same. Sections in the shape of single impulses are used for the production of what is called, in physiology, single contractions for diagnostic purposes, or for treatment of muscles requiring an especially lenient treatment. Sections may also be used in sensitive measurements with the use of high frequency.

PREBEN MORLAND.
JORGEN ADOLPH SMITH.

PUBLISHED

MAY 25, 1943.

BY A. P. C.

P. MORLAND ET AL

APPARATUS FOR TREATMENT OF NERVES AND MUSCLES
BY MEANS OF ELECTRIC IMPULSES

Filed Sept. 3, 1941

Serial No.
409,385

3 Sheets-Sheet 1

Fig. 1.

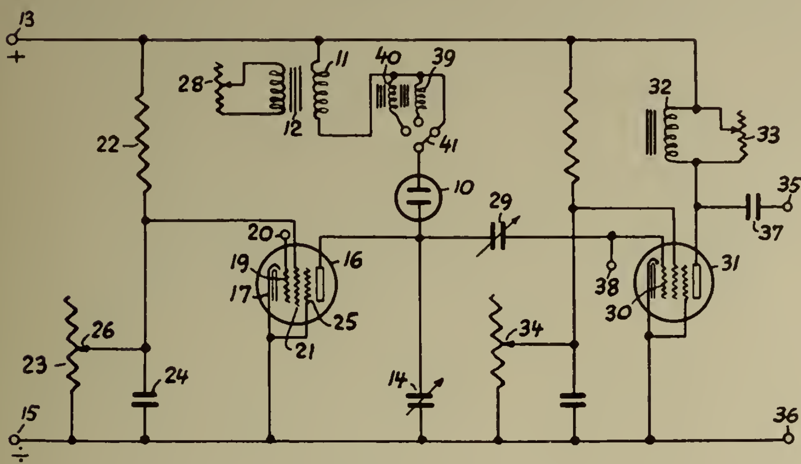


Fig. 2.

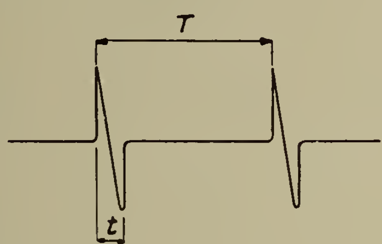


Fig. 3.

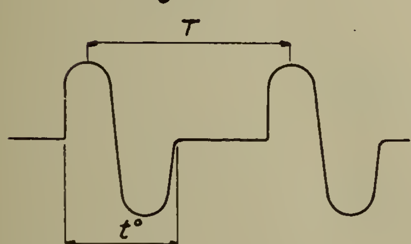
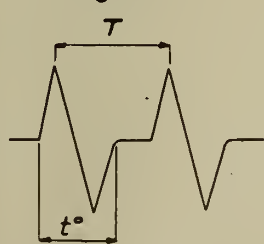


Fig. 4.



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APPARATUS FOR TREATMENT OF NERVES AND MUSCLES

BY MEANS OF ELECTRIC IMPULSES

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Serial No.

409,385

3 Sheets-Sheet 2

Fig. 5.

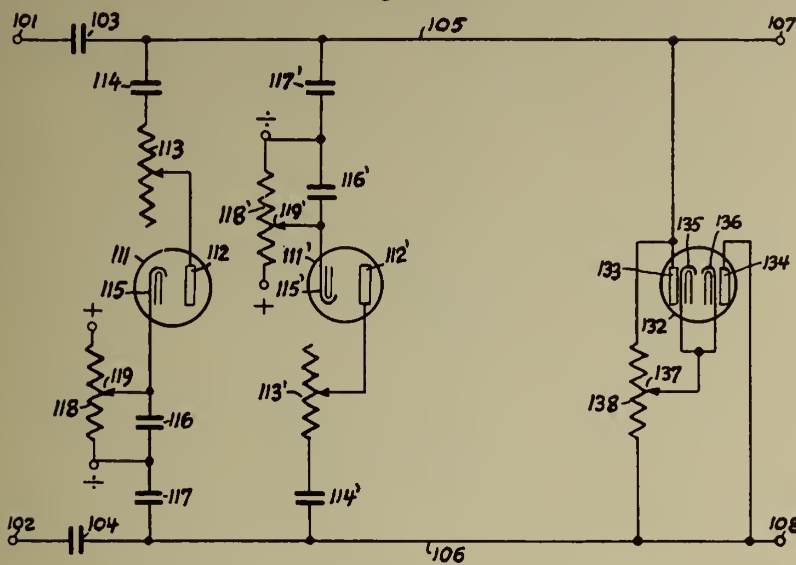

Fig. 6.

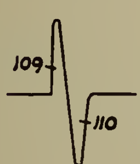

Fig. 7.

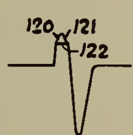

Fig. 8.

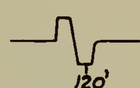

Fig. 9.

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Serial No. 409,385

3 Sheets-Sheet 3

Fig. 10.

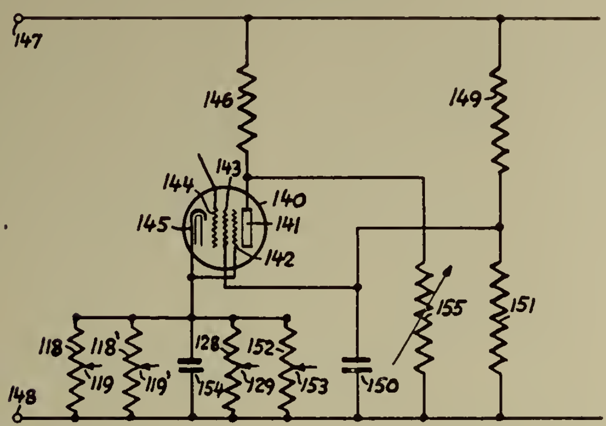


Fig. 11.

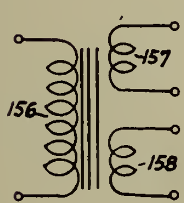


Fig. 12.

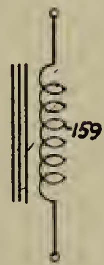
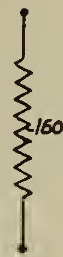


Fig. 13.



ALIEN PROPERTY CUSTODIAN

ELECTRICAL HEATING OF ARTICLES MADE OF GLASS OR OTHER VITREOUS MATERIAL

Maurice Descarsin, Paris, France; vested in the Alien Property Custodian

Application filed September 25, 1941

The electrical heating of articles made of glass, or other vitreous material, to a temperature sufficiently high to allow them to be shaped, and in particular, to cut them or to weld them to each other or to other articles, can be effected in various manners, in particular by electric arcs or sparks which are directed on to the glass, or by dielectric losses which take place in the field of a condenser the armatures of which are connected to a source of alternating current of very high frequency.

It is thus, for instance, that glass members such as a bulb of a thermionic valve and a base or foot forming admission for the electrodes have been welded together, by causing to pass in the glass an electric current of high voltage (10 to 20 kv) and of high frequency (1 megahertz) by means of strong electrodes and, in certain cases, of blow-pipe flames serving as gaseous conductors for localizing the discharge in the region of the glass to be heated. This process has the double inconvenience of necessitating, on the one hand, the use of a high voltage, which entails difficulties of insulation and the risk of danger for the staff, on the other hand, a complicated apparatus owing to the fact that it is necessary to adjust the direction and the spacing apart of the sparks which raise the glass to melting temperature, and to use, in most cases, the flame of a blow-pipe.

Therefore, it has already been proposed, in particular for fixing the bulbs on the glass bases, to place these articles in the electric field of a condenser of still higher frequency, reaching 10 megahertz, but of much lower voltage of the order of 1 kv, the heating being then effected by dielectric losses and not, as in the other process, by means of a current passing in the glass. The device for carrying out this heating method was not only very simple, but the manipulations it required presented the minimum risk and danger for the staff charged therewith; moreover the energy consumed was appreciably lower than that when heating by means of electric arcs or sparks. On the contrary, the rise in temperature by dielectric losses in the mass of glass was very slow at the beginning of the heating, as said losses are so much the lower as the glass is colder and, moreover, it was difficult to exactly circumscribe the heating zone by maintaining a suitable temperature at each of its points.

The present invention remedies these inconveniences. It has for object a process which allows of obtaining a local heating of the glass which is both rapid and economical, and of accurately controlling the intensity of the heating in a given region of the glass.

The process according to the invention consists, in the first place, in preheating said region by any source of heat raising the temperature to about 200°, that is to say, consuming a small number of calories, before subjecting the glass to the action of the electric field, so as to increase, at the very beginning of said action, the dielectric losses which originate in the glass.

It moreover consists in focussing the lines of force of the field in said region by giving to the armatures of the condenser an arrangement and/or a shape suited to the size and shape of the region and, in particular when the glass articles are hollow, in arranging within said articles, and opposite the armatures, suitable focussing members. Said members present, over those already used for focussing on a given region of the glass, the flames of a blow-pipe or electric sparks, the advantage of being fixed, that is to say, of necessitating no adjustment during the operation for softening and melting the glass.

Finally, the process according to the invention consists in imparting a relative movement to the glass article and to the armatures of the condenser, as well as to the focussing members, when the shape and arrangement of said armatures do not allow the electric field to act simultaneously with the desirable intensity in all the points of one and the same region.

The preheating is preferably effected by electric resistances, either independent, or combined with the armatures or the focussing members, said armatures and members then serving at the same time as sources of heat.

The movement which is imparted, either to the glass article, or to the armatures of the condenser and to the focussing members, or to all at the same time, is preferably obtained by a movement of rotation about the axis of a cylindrical portion of the glass article when the heated region is in said cylindrical portion.

The accompanying drawing illustrates, by way of non limiting examples, various methods for carrying out the process according to the invention.

Figs. 1 to 9 are diagrammatic views in longitudinal section showing various embodiments of the invention.

Fig. 10 shows a detail.

Fig. 11 diagrammatically shows an apparatus for carrying into practice the process according to the invention intended for the welding of bulbs on the bases of thermionic valves.

The same reference letters have been used in the various figures to designate the same elements:

The article made of glass or other vitreous material is designated by the letter V, the region of said article which is to be heated in order to shape it, is limited by two dotted lines and designated by R, the armatures of the condenser by A, the supplementary members for focussing the field, independent from the armatures or not, by C, the source of high frequency electric current by F, the preheating source allowing to raise the temperature of the region R, by T, and earth by M.

The glass rod V illustrated in fig. 1, the small annular part R of which is to be heated, in order to cut said tube in said part, for instance, is placed between the two flat armatures A connected to the source of high frequency current F; said armatures are provided with transverse projections C having a low coefficient of dielectric losses and the protuberant part C of which is at the level of the center of the portion R which is to be heated.

The glass tube V illustrated in figs. 2 and 3 is also placed between two flat armatures A, but, in this case, it is preferable to arrange the focussing members C, of suitable shape, within the tube and opposite the armatures, said members being preferably made of metal and earthed.

In the case of a hollow article, as shown in fig. 4, the armatures can also be arranged concentrically, one outside, the other inside the article; the focussing of the field being obtained by projections C carried by one or the other of the two armatures, or by both armatures.

In fig. 5 the armatures are external, and their frustum-like shape allows of focussing the field towards the small base of the truncated cone.

In Fig. 6 the device of Fig. 5 is completed by the addition of a focussing member arranged within the article.

The device of Fig. 7 is a modification of that of Fig. 6, the armatures having the shape of torii.

In the devices of Figs. 1 to 7, the method for preheating the glass article is not indicated.

By way of examples, Fig. 8 shows a device for preheating by radiation of one of the armatures, heated in its turn by electric resistances, and Fig. 9 shows a device for preheating by radiation of a focussing member, heated in its turn by means of an independent source of heat.

In the case in which it is desired to use one of the armatures for preheating, it can advantageously be constituted, as shown in Fig. 10, by a suitably cut out metal plate, or by resistances of appropriate nature and suitably grouped and focussed.

Fig. 11 shows a device allowing to section in the hot state the neck of a bulb of a thermionic valve and to weld said neck, at right angles to the section effected, on the base or foot made of glass which serves for admitting the electrodes.

The glass bulb **1** comprises a neck **2** and a bulged head clamped in a support **3** which receives a movement of rotation about the axis of the bulb by means of a gear **4** and a pinion **5** keyed on a shaft **6**. The foot **7**, the base of which has a flared portion **8** is extended by a tube or pinch **9**, which is clamped in a sleeve **10** receiving a movement of rotation, synchronous with that of the support **3** and about the same axis, owing to a gear **11** and a pinion **12** keyed on shaft **6**, the gear **11** and pinion **12** having respectively the same diameters as gear **4** and pinion **5**. The sleeve **10** carries a screen **13** intended to shelter the pinch from the radiation of heat given out both by the internal flange-shaped focussing member C heated, as in the device of Fig. 7, and by the region R of the neck of the glass bulb, said region being in its turn heated by any means, such as heating resistances, not shown.

The operation of the device of Fig. 11 is as follows:

During the synchronous rotation of the bulb **1** and of the base **7** in the electric field created by the armatures A, a very hot zone of small height appears at R, at the level of the flange C, and after a certain time, which is function of the nature and thickness of the glass, of the intensity and frequency of the electric field and of the temperature generated in the zone R, the glass of the neck **2** melts in said zone and the lower part of the neck becomes detached and falls by its own weight.

If, at this moment, the high frequency current feeding the armatures A is stopped, a clear sectioning of the glass is obtained with somewhat rounded edges.

If, on the contrary, the high frequency current is maintained, a rim of molten glass is formed, which rises by thickening and finally encounters the edge of the flared portion **8**, in such a manner that said edge is welded to the lower rim of the bulb.

Owing to this process the flange **8** of the base **7** is heated at the same time as the neck **2** of bulb **1**, first of all by the preheating, then by dielectric losses and finally by the radiation of the heat generated in the non-detached upper part of the region R of the neck **2**, so that, at the moment the molten glass rim which rises and thickens comes in contact with the flared portion **8**, the latter has the same temperature as said rim.

By means of this device, very strong weldings are therefore obtained with the minimum tension in the glass; furthermore, the electric heating, by eliminating any trace of humidity, prevents the deterioration of the electrodes of the thermionic valves, whereas, in the ordinary welding process by means of a gas blow-pipe, it is necessary to eliminate the steam contained in the gas by costly means necessitating constant supervision.

The device of Fig. 11 is an example of a particularly advantageous industrial application in circumstances in which there is a shortage of gas for heating; the consumption of gas is, in fact, very important, in the blow-pipe welding process.

Moreover, all the applications which utilise the process of the invention for shaping in the hot state any articles made of glass or other vitreous material, for instance, for compressing, flattening, flaring, or drawing-out certain parts thereof, are included in the scope of the invention.

MAURICE DESCARSIN.

PUBLISHED

MAY 25, 1943.

BY A. P. C.

M. DESCARSIN

ELECTRICAL HEATING OF ARTICLES MADE OF GLASS OR OTHER VITREOUS MATERIAL

Filed Sept. 25, 1941

Serial No. 412,345

Fig.1

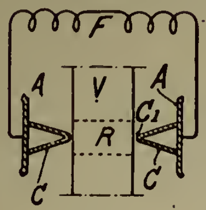


Fig.2

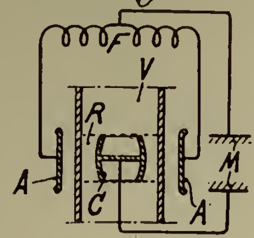


Fig.3

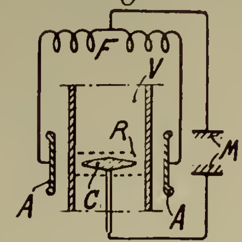


Fig.4

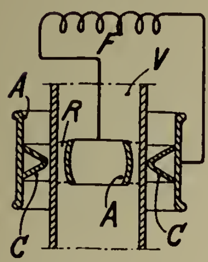


Fig.5

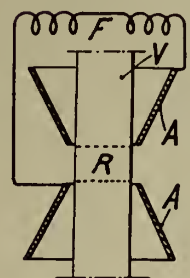


Fig.11

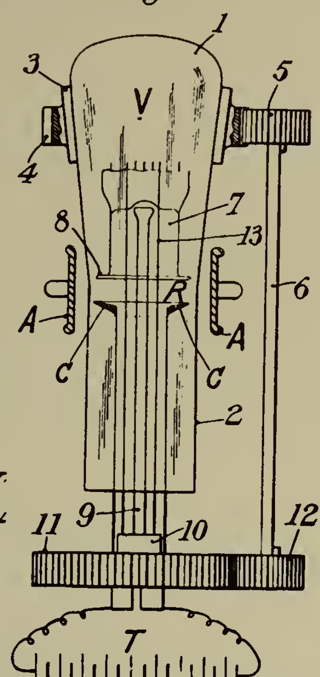


Fig.6

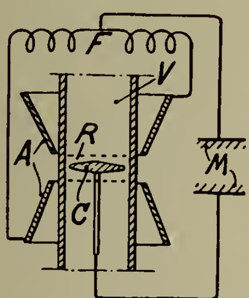


Fig.7

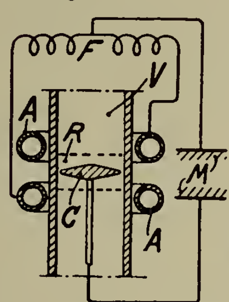


Fig.8

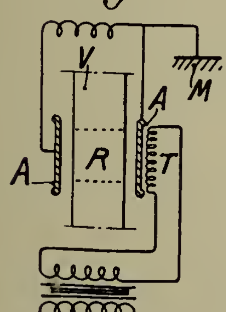


Fig.9

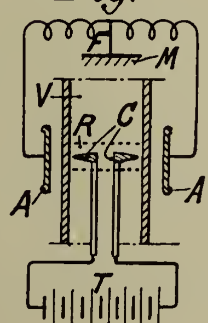
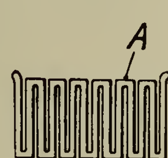


Fig.10



Inventor:
M. Descarsin
By E. F. Wenderoth
Atty

Published May 25, 1943

Serial No. 412,522

ALIEN PROPERTY CUSTODIAN

PACKING IN TINS

King Theodoor Limm, Soerabaja, Java, Netherlands East Indies; vested in the Alien Property Custodian

Application filed September 26, 1941

My present invention bears relation to the closing of tins.

The closing of tins, which serve as airtight packing by means of a cover that in most cases is soldered to the tin, is well known. In many cases also screwlids are used.

The first-mentioned device often causes some difficulty by the opening of such tins. A knife is needed with which an opening must be cut. Also the soldering of the lid is a cumbersome, expensive work taking up much time.

A screwlid is much less cumbersome as the opening of such tins does not cause so much trouble.

This latter device involves, however, trouble of another nature, especially if the tins must hold goods that are subject to deterioration.

In such cases it is considered of great importance, to prevent the use of such a tin, after it once has been opened, as a packing of the same sort of goods. This is made possible when such a tin box, after having been opened, cannot be closed again by the same lid.

To accentuate this the device involves the use of a kind of crowned cork, which is projected in such a way that it clamps round the bend rim of the receptacle, which clamping can, if necessary, be increased by making the rim of the tin box resilient.

When removing the crowned cork from the box also the rim of the box will be bent out of shape in such a way that a good closing of the box is not possible more.

To make the effect still greater the bend rim can be provided with incisions, which facilitate the deformation of the rim of the box.

For further elucidation we refer to the drawings that is added hereto, and on which, by way of example, schematically some projects are given according to the invention.

On Fig. 1 is shown a smooth, bend rim of a tin box. Fig. 2 shows a similar box closed by a crowned cork, while Fig. 3 shows the bend rim provided with incisions and Fig. 4 another form of a tin box.

Fig. 5 shows an example of a bend box-rim which rim is made resilient, which resiliency can be increased by cutting in the rim.

Such a closing of tin boxes with big crowned cork is new and affords the manufacturer the great advantage, that, when used on boxes containing goods which are liable to deterioration, these boxes can be easily closed without any cumbersome soldering; for the consumer it means that the tins can be easily opened, while the goods can be marked as unfit for use when the lid does not longer fit tightly on the box.

Tins with such a lid can also be used for the packing of fluids, for which tins with a screwlid are less suitable. For further illustration we may refer to the following statement.

The butter-oil produced at Java has been packed to this moment in tins containing 1 litre, with a soldered lid. The average housewife will do 14 days with 1 litre oil. As soon as the tin has been opened the housewife has to put the oil in bottles, as it cannot be kept in an open tin. This decanting is very cumbersome and requires, moreover, a number of bottles.

Which advantages are obtained if this oil would be packed in tins with a closing according to the invention (f. i. in the shape as shown in Fig. 4).

1st. The butter oil-manufacturer can work more economically as the cumbersome, expensive and time-absorbing soldering could be suspensed with.

2nd. The consumer will be able to open the tin with more ease.

3rd. The burdensome decanting is no longer necessary as the tin can easily be closed with a usual cork, while the oil can easily be poured out through the shape of the tin.

All taken in one, such a tin has all advantages of the ordinary tin, together with that of a bottle, but without the defects of same, such as cumbersome soldering, many troubles by the cutting of the lid, fragility and a heavier weight.

This invention gives much ease and economy to the producer as well as to the consumer, so that an important technical effect is obtained.

In this way a practical closing for tin packings is effected which means a solution in many ways, especially for fluid and deteriorable goods, which are for household-use.

KING THEODOOR LIMM.

PUBLISHED
MAY 25, 1943.
BY A. P. C.

K. T. LIMM
PACKING IN TINS
Filed Sept. 26, 1941

Serial No.
412,522

FIG. 1

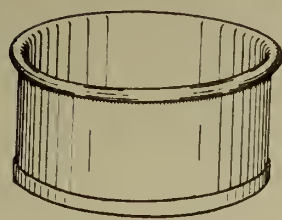


FIG. 5

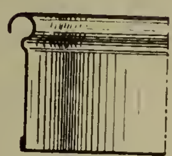


FIG. 2

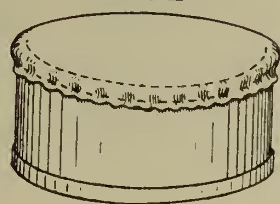
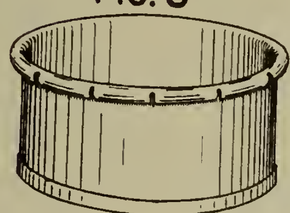


FIG. 3



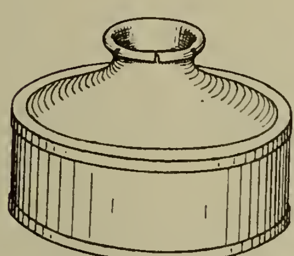


FIG. 4

Inventor;
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ALIEN PROPERTY CUSTODIAN

WASHING AND CLEANSING AGENT WHICH REMAINS HOMOGENEOUS AND A PROCESS FOR THE PREPARATION OF SUCH AGENT

Marie Joseph Hubert Edmond Hustinx, Maastricht, Netherlands; vested in the Alien Property Custodian

No Drawing. Application filed October 3, 1941

The application relates to a washing- and cleansing agent which remains homogeneous, and to a process for the preparation of such agent.

Already numerous washing- and cleansing agents are known. It is for instance known that alkali silicates show in a diluted condition properties analogous to soap solutions as regards dissociation and adsorption. Silicates have also cleansing properties in concentrated condition. However, silicates show unfavourable properties which appear particularly when cleansing fabrics and also when silicates are mixed with other electrolytes. Sharp particles will settle in the fabrics, causing these to be damaged. Sulphonic acid alkalis have apart from other favourable properties a great moistening capacity, owing to which also these substances, either or not mixed with soap and together with the usual additions to soap, are applied as cleansing agents. As such additions for example sodium phosphate, sodium carbonate, borax, alkali silicates, etc. are used.

I have found that by mixing water soluble silicates and sulphonic acids or alkali sulphonates in a proportion of at least 2 parts by weight of silicate, based upon concentrated water glass of 37–40° Bé to one part by weight of sulphonic acid, a washing and cleansing agent is obtained which remains homogeneous and entirely replaces soap, which is, however, cheaper and even surpasses soap for certain washing purposed, so that in those cases it is to be preferred before the latter.

By mixing a water soluble silicate and a sulphonic acid or an alkali sulphonate according to the invention a mixture is obtained both components of which supplement each other with respect to the washing action. If an alkali silicate is mixed in hot condition or at room temperature with soap the latter separates out as top layer; it is as it were salted out with detrimental consequences with regard to the condition of the silicate. If, however, a sulphonic acid salt is used for mixing particularly in a ratio of at least two parts by weight of silicate, based upon concentrated water-glass of 37–40° Bé to one part by weight of sulphonic acid, then a completely homogeneous washing- and cleansing agent is obtained which retains this condition due to its high specific weight as well as to its better power of resistance against salting out.

The term sulphonic acids comprises all sulphonating products of organic compounds with their various derivatives, which increase the moistening, impregnating and emulsifying properties and decrease the surface tension. As an example may be mentioned sulphonic acids of hydroxy-fatty acids (ricinus oil) and fat alcohols of fatty acids and mineral oil (true sulphonic acids in which the sulphur is for the greater part directly bound to the carbon atom); alkyl-aryl sulphonic acids, such as e. g. the reagents for the splitting up according to Twitchell, lignine- and humine-sulphonic acids (splitting products of wood, peat, coals). These mixtures which are homogeneous both in cold and hot condition will be liquid, pasty or hard in cold condition dependent on the concentration. Such a mixture also remains homogeneous, if a small proportion of electrolytes are added e. g. alkali carbonates, alkali phosphates and the like. The nature of the acids and of the electrolytes determine the permissible proportions.

The application is limited to a percentage of other electrolytes which does not exceed 110% of the silicate content, based upon dry substance. The silicates are present in the molar proportion: $NaO:SiO_2$ of 1:1 up to 1:4 inclusive dependent on the purposes for which they are to be used and the composition of the mixture.

The following examples are given for illustrating purposes without the invention being restricted thereto:

	Parts by weight
1. Water glass, 37–40° Bé	100
Caustic soda lye, 38–40° Bé	30

to which a mixture of:

Alkyl-aryl sulphonic acid	4
Water	4
Caustic soda lye, 38° Bé	2

is added.

	Parts by weight
2. Water glass, 37–40° Bé	100
Potassium hydroxide, 50° Bé	55

to which 2 kilograms of sulphonated ricinusoil are added.

	Parts by weight
3. Sulphonated mineral oil	10
Sulphonated ricinus oil	10
Potassium hydroxide, 50° Bé	10
Water	10
Water glass, 37–40° Bé	60
	100

	Parts by weight
4. Sulphonated mineral oil	10
Water	10
Caustic soda lye, 38° Bé	5
Sodium carbonate	19
Water glass, 37–40° Bé	56
	100

	Parts by weight
5. Lignine sulphonic acid	10
Water	20
Caustic soda lye, 38° Bé	5
Water glass, 37–40° Bé	60
Trinatriumphosphate	5
	100

MARIE JOSEPH HUBERT EDMOND HUSTINX.

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ALIEN PROPERTY CUSTODIAN

ENDLESS SOUND BAND WITH A MECHANICALLY REPRODUCIBLE SOUND RECORD AND METHOD OF PRODUCING SAME

Hugo Westerkamp, Koln-Poll, Germany; vested in the Alien Property Custodian

Application filed October 3, 1941

The invention relates to a method of producing endless sound bands, with a number of mechanically reproducible sound tracks running parallel or nearly parallel to the edge of the band, from a bounded matrix made from an endless original sound band, for example a wax band, and further relates to sound bands, particularly endless sound bands, produced according to this method.

In the production of endless sound bands with a mechanically reproducible sound track bundle, it is preferable to produce a bounded matrix from an endless original sound band, for example an endless wax band, then to make impressions of this bounded matrix on bounded thermoplastic bands, or to use this matrix for producing bounded sound bands in series in some other manner, for example by a casting or a spraying process, and finally to connect the ends of the bands with each other. For this purpose, the endless original sound band may either be cut across the sound tracks and be used in its bounded form for producing a bounded matrix band, or there may be produced from the original sound band, which is left in its endless form, a likewise endless matrix band, and this may be cut across the sound tracks. In both cases it is difficult, when the sound tracks have been cut, to connect the ends of the sound bands produced in series so as to ensure a proper alignment of the sound tracks forming the sound track bundles at the two ends of the bands. However, such an alignment is absolutely necessary, in order that the connected sound tracks should enable a continuous reproduction.

The object of the invention is to obviate this difficulty. This is achieved by providing the original sound band or the matrix band by means of a gauge with marks on both sides of the separating line passing across the band, which marks are moulded in the duplicating process, and by bringing the moulded marks of the duplicated band with the aid of the gauge into the position ensuring the proper alignment of the sound tracks of the sound track bundle at both ends of the band.

The marks are preferably made outside and on both sides of the sound track bundle, and advantageously consist in grains formed on the original sound band.

The idea of the invention is not only applicable to the production of endless sound bands, i. e. in connecting the free ends of freshly produced bounded bands, but also in repairing torn bounded or endless sound bands by sticking them together or the like. For this purpose, the invention proposes to provide the sound band on its entire length at the side of the sound record with marks distributed at certain distances, which, when the band gets torn, may be brought by means of a gauge into the relative position in which the sound tracks at both ends of the band are properly aligned.

The method according to the invention is illustrated by way of a constructional example in the accompanying drawing, in which:

Fig. 1 is a view of a portion of an endless original sound band;

Fig. 2 is a section on the line II—II of Fig. 1;

Fig. 3 is a view of a portion of the matrix band produced from the original sound band according to Fig. 1; the portion corresponds to that shown in Fig. 1;

Fig. 4 is a section on the line IV—IV of Fig. 3;

Fig. 5 is a view of a portion of a ready sound band produced from the matrix band according to Fig. 3; and

Fig. 6 is a section through the sound band according to Fig. 5 on the line VI—VI, showing the sound band and also the connecting gauge applied in connecting the ends of the band.

The original sound band illustrated in Figs. 1 and 2 consists of a carrier layer **1** of nitrocellulose covered with a wax layer **2**. It is recorded in its endless form, the sound grooves **3** being cut by means of a stylus into the wax layer, which sound grooves run parallel or nearly parallel to the edge of the band and represent a continuous helically shaped sound track.

It is supposed that in producing an endless matrix band from the original sound band, the latter is cut along the line A—B. Before this cut is effected, the marks **4** are made in the sound record layer by means of a gauge which marks, in the constructional example illustrated, consist of grains in the wax layer.

After making the marks **4** on the original sound band, which is cut across the sound tracks, a bounded matrix is produced. Such a matrix is illustrated in Fig. 3, showing the two free ends of the matrix band **5**. On these ends of the band the hollowed out marks **4** of Fig. 1 appear as projections at **4'**.

The sound bands **6** (Fig. 5), produced from the matrix band **5** by a pressing, stamping, casting, or spraying process, have on their recorded surface the hollowed out marks **4**. For connecting the free ends of the sound band **6**, the latter is chamfered as shown at **7**, and the grain points **8** of the connecting gauge **9** are inserted in the

grains **4**. Consequently, the free ends of the band exactly occupy the position corresponding to the alignment of the sound tracks of the sound track bundles at the two ends of the band, so that, when the ends of the band are stuck together in this position, it is certain that the sound tracks of the duplicated band exactly occupy the position of the sound tracks in the original sound band before the cut A—B was made.

If the cutting across the sound tracks is effected in a matrix band which was first produced as an endless band, it will be sufficient to make the alignment marks on the matrix band.

The aligning marks are not only advantageous for the proper connection of the free ends of a bounded band in producing an endless band, but also in repairing torn endless or bounded sound bands. For this purpose, it is advisable to provide the sound band on its entire length at the side of the sound tracks at certain distances with aligning marks. When such a band gets torn at a place, the proper connection of the ends of the band may be easily and securely effected by bringing a connecting gauge to engage the marks adjacent to the place where the band is torn. In Fig. 5 the additional marks provided at certain distances along the sound band are indicated at **10**.

HUGO WESTERKAMP.

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BY A. P. C.

H. WESTERKAMP
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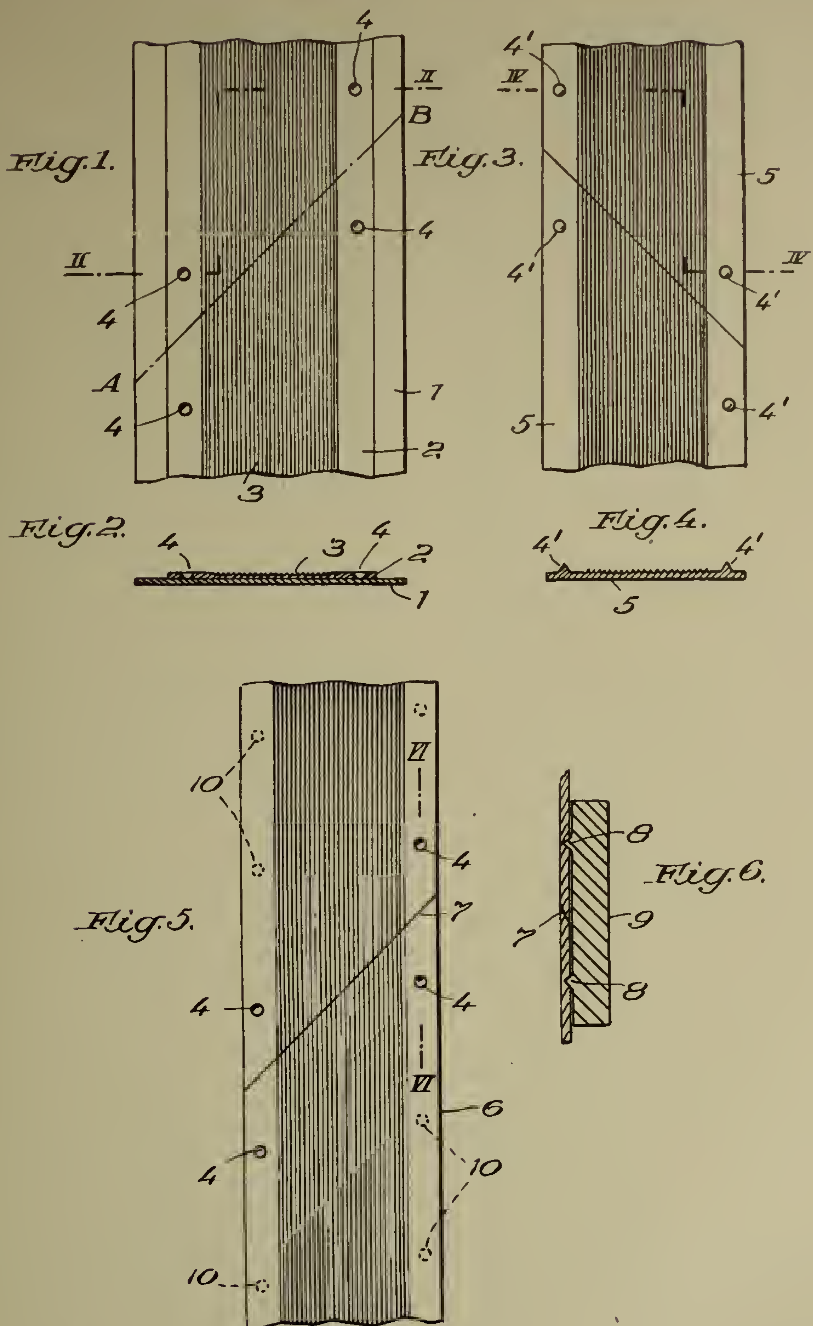

Inventor:
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Attorneys

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ALIEN PROPERTY CUSTODIAN

VEHICLES, PARTICULARLY MOTOR VEHICLES HAVING OSCILLATING HALF AXLES

Otto Winkelmann, Stuttgart-Degerloch, Germany; vested in the Alien Property Custodian

Application filed October 8, 1941

The present invention relates to vehicles, more particularly to motor vehicles having oscillating or pendulum half axles. Motor vehicles of this kind often tend to oscillate about the frame or the car body, i. e. to perform the so-called rocking which may hardly be obviated by larger dimensioning the oscillating members. This latter method, besides causing an undesired increase in the weight of the vehicle and a too rigid and torsional stiff frame, has the drawback of an undamped transmission of shocks and noises.

Now, the invention provides an increase of the torsional elasticity between the axles of the vehicle to reduce the natural vibrations of the car system about its longitudinal axis, so that the vibrating movements are no longer experienced by the passengers to be troublesome, but appear in the form of weak slowly occurring amplitudes. To this purpose the axle aggregate, consisting more particularly of pendulum half axles, is connected to the rest of the vehicle by the interposition of elastic members, for instance rubber buffers, in a manner to be elastically rotatable about a longitudinal axis, the springs, serving the purpose of shock absorption of the wheels, and the rubber buffers being connected one after the other (therefore in series) in the sense of the power transmission from the wheels to the car body. Hereby simultaneously the transmission of shocks and noises from the wheels to the frame or the car body is prevented.

A further reduction of the oscillating phenomenons may be obtained by arranging the springs, absorbing the shocks of the wheels, in such a manner that they act as compensating springs, i. e. totally or partially give way due to oppositely directed or unequal large lifting movements of the wheels of a wheel axle without exerting upon the car body or the supporting member carrying the members guiding the wheel a force returning these elements (direction force). The wheels for this purpose are thus arranged relatively to each other that they mutually absorb their shocks particularly directly.

By the torsional elastic connection of the axle aggregate to the rest of the vehicle, however, the lifting action exerted upon the car body on lateral inclinations of the latter and thereby the safety of the car body when taking curves is reduced, more particularly if compensating springs are provided at this axle. To increase this safety in taking curves, however, the other axle preferably may be provided with an additional spring arrangement, for instance a so-called balancer, effecting setting upright the car body.

If it is, however, desirable to reduce only relatively slightly the lifting action exerted upon the car body by the axle torsionally elastically connected to the rest of the vehicle, or, if the torsional elasticity of the connection is sufficient to remove the undesired oscillating phenomenons, the springs, absorbing the shocks of the wheels, may also bear against the supporting member, for instance a differential gear, which carries the pendulum half axles and torsionally elastically is connected to the rest of the vehicle. In this case, on lateral inclinations of the car body and thereby of the supporting member also with an amplitude admitted by the torsional elasticity provided between the supporting member and the rest of the vehicle, the springs absorbing the shocks of the wheels also act in a setting upright manner upon the car body.

To effect the torsional elastic connection of the supporting member, for instance the differential gear casing, carrying the pendulum half axles or the like, to the rest of the vehicle, preferably rubber rings of annular, oval or similar form or pneumatic devices, e. g. elastic, air filled containers of rubber or elastic metal or other elastic members constructed and arranged in such a manner are provided which particularly with the elements to be united together, are adhesively connected and effect a resiliency essentially or exclusively in the direction of rotation about a longitudinal axis, these resilient or elastic members preferably being arranged in front and in rear of the oscillating or pendulum half axles.

In the accompanying drawing some constructions according to the invention are shown diagrammatically and by way of example.

In this drawing:

Fig. 1 is a plan view of a vehicle frame provided with a rear axle aggregate torsionally elastically arranged at the frame and a front wheel suspension employing an additional spring arrangement for setting upright the carriage body.

Fig. 2 is a rear elevation of the rear axle aggregate according to Fig. 1, and

Fig. 3 is a rear view of a modification of the rear axle aggregate of the construction shown in Fig. 1.

Connected to the frame *a* are the front wheels *b* and the rear wheels *c* which latter are mounted upon oscillating or pendulum half axles *d*. These half axles are linked to the vehicle in the middle longitudinal plane of same, or, as shown for instance in Fig. 3, by means of lateral links *e* to the differential gear casing *f*. The latter is provided with projections *g* and *h* directed forward-

ly and rearwardly respectively which extend in the longitudinal direction of the vehicle and are surrounded by rubber rings i and j respectively inserted in corresponding bearing eyes k and l respectively of the frame. The rubber rings preferably are adhesively connected for instance by vulcanization to inner and outer metal sleeves m and n respectively. The inner metal sleeves m are fixed to the projections g and h respectively, the outer metal sleeves n to the bearing eyes k and l respectively of the frame.

In the construction of the rear axle according to Fig. 2, the rubber rings have circular cross section. To absorb the shocks of the wheels one or more tension springs o are provided the two ends of which are connected to projections of the half axles d. The springs o are so arranged that the two half axles d mutually absorb the shocks acting upon the wheels supported by these half axles. In a manner known per se a so-called compensating action of the springs, absorbing the shocks of the wheels, is obtained hereby.

According to the construction of the rear axle shown in Fig. 3 the springs, absorbing the shocks of the wheels or the half axles respectively, and constructed for instance as non-guided helical springs bear with their upper ends against a beam q fixed to the differential casing f and, therefore, together with the latter is mounted by means of the rubber rings i and j in a torsional elastic manner with regard to the rest of the vehicle. In the present case the rubber rings have an oval cross section so as to effect a progressively increasing elastic resistance when the differential gear casing, serving as supporting member for the oscillating half axles, yields with regard to the frame. A particularly large initial resiliency may thereby be chosen without the total resiliency assuming inadmissible large values.

The front wheels b may for instance, in a manner known per se, be suspended from the frame a by two links r arranged one above the other in the manner of link parallelograms and the shocks of these wheels may be absorbed by a helical spring s the lower end of which bears against the lower link and the upper end of which bears against a bearing block fixed to the frame. To increase the safety of the frame when taking curves, a torsional rod-like spring u is, moreover, rotatably mounted in a tubular cross beam t of the frame upon the ends of which spring levers v are fixed the free ends of which may in any suitable manner be connected to the wheel suspension, for instance to the wheel support or one of the guide links. This torsional rod-like spring u is deformed only, if unequal lifting movements of the front wheels occur.

Owing to the torsional elastic connection of the rear axle aggregate to the frame or to the car body respectively by means of the rubber rings i and j unequally directed or unequal large lifting movements of the rear wheels may partially and mutually be compensated without being transmitted to the frame or to the car body respectively. Simultaneously the number of oscillations of the total oscillating system, formed by the frame and the car body as well as by the two axles, about the longitudinal axis of the vehicle is reduced. The absorption of shocks of the rear wheels is weaker, particularly in connection with the construction according to Fig. 2 and shocks and noises are dampened in a most agreeable manner due to metallic contact between axle- and frame- members or members of the car body respectively being obviated. Simultaneously, however, the torsional rod-like spring u, i. e. a so-called balancer, acting as an additional spring for lifting the car body eventually effects a sufficient safety of the frame or the car body in taking curves.

Of course, the invention is not to be limited to the constructional examples shown. For instance, the individual features of the constructions shown in Figs. 2 and 3 could be exchanged one against the other by using for instance in the construction according to Fig. 2 ovally constructed rubber rings or by employing equalizing springs o in the modification shown in Fig. 3 instead of the springs p or additionally thereto. Also instead of rubber rings individual rubber plates or the like arranged in a circle or in a similar manner may be provided.

Instead of the rear axle or simultaneously therewith, moreover, the front axle also may be torsionally elastically connected to the rest of the vehicle by elastic members. Moreover, the elastic members need not be arranged directly at the axle, but may be interposed at other places also, as long as they are arranged in the power transmission path between the two axles or between the one axle and the car body respectively. A special frame may be omitted for instance by the use of self-supporting car bodies.

The torsional elastic connection of the axle aggregate to the rest of the vehicle is of special importance when using gauge altering pendulum half axles. The torsional elastic connection, however, may be employed also in connection with other arrangements of oscillating axles or independent wheel suspensions and eventually in connection with rigid axles too. It may be furthermore used in connection with vehicles generally and also to vehicles (motor vehicles) with more than two axles.

The invention may, moreover, also be used without a balancer provided at the axle arranged opposite the torsionally elastically mounted axle. The wheels of the last mentioned axle, i. e. particularly the wheels of the front axle, may eventually be suspended in any desired manner from the frame or the car body of the vehicle respectively. For these wheels, however, principally parallel or link parallelogram connections come into consideration.

Generally speaking it is of course also possible to apply the invention only to one or some of the axles viz. axle-pairs of one vehicle and it is furthermore possible to provide a vehicle with one or some oscillating axles or pairs of oscillating half axles only.

OTTO WINKELMANN.

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VEHICLES, PARTICULARLY MOTOR VEHICLES HAVING OSCILLATING AXLES

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Fig. 1

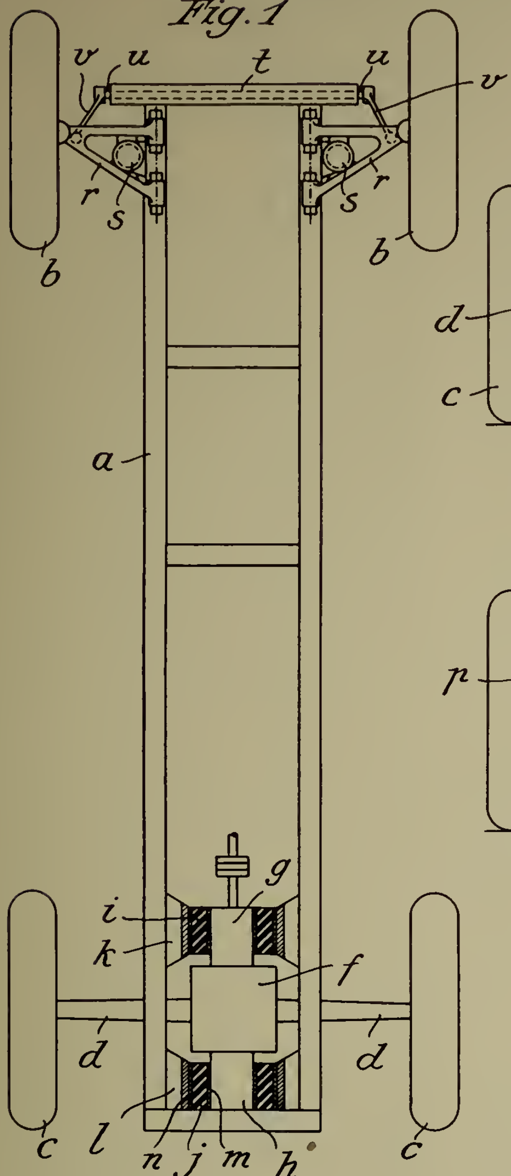


Fig. 2

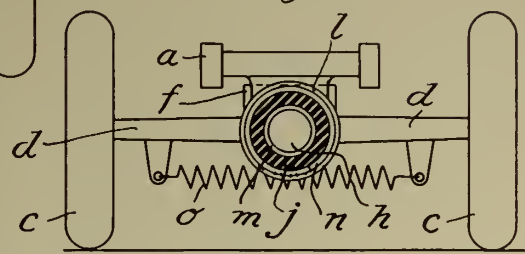
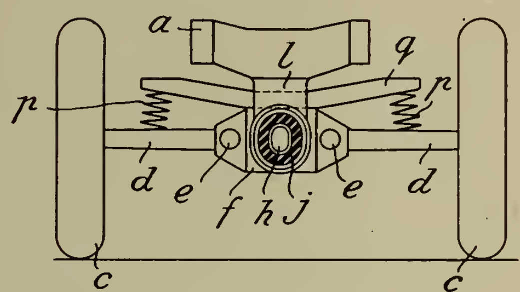


Fig. 3



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ALIEN PROPERTY CUSTODIAN

MOVABLE CONNECTION OF A VEHICLE BODY WITH THE CHASSIS OR AN AXLE AGGREGATE

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Application filed October 8, 1941

The present invention relates to a movable connection of the vehicle body with the chassis or an axle aggregate of a vehicle.

Motor vehicles are known already in which the car body is resiliently connected to the chassis or to the axle aggregates in such a manner that the car body may oscillate with regard to the chassis or to the vehicle axles about a longitudinal axis of rotation arranged in the height of the resilient bearings or above the road. Hereby, particularly in connection with oscillating axles, more especially with oscillating half axles which strongly alter the gauge, rocking phenomenons, due to transverse shocks transmitted to the car body and occurring in the axle joints, may be produced which are the stronger, the higher the longitudinal axis of rotation is arranged and the nearer it is positioned to the centre of gravity of the car body. This phenomenon is based on the fact that the lever arm of the inertia forces acting in the centre of gravity is not long enough to be able to sufficiently yield in a lateral direction on transverse shocks occurring at the axle aggregate or at the chassis.

These drawbacks are obviated by the present invention by positioning the centre of the gravity of the body and the longitudinal axis of rotation at least approximately in a vertical plane, the axis being outside the centre of gravity. The axis of rotation is determined by the movable connection between the body and the chassis or the axle aggregate or aggregates (rest of vehicle) respectively. The axis of rotation is preferably positioned substantially in the height of the road. The oscillation phenomenons occurring at the car body hereby are reduced to a minimum. The invention may be employed in connection with front axles and rear axles is, however, particularly adapted for use in connection with the latter or with both. Also more than two axle aggregates and also one axle aggregate (trailer) may be provided, the invention being applied to one, some or all aggregates.

Preferably resilient bearings, for instance rubber bearings, are provided which besides allowing principally a resiliency to and fro from the longitudinal axis, simultaneously allow a resiliency into an other, some or all other directions. Furthermore pneumatic devices of rubber may be provided or pneumatic devices of resilient metal or guided coiled springs. The two latter constructions have the drawback that metallic contact will take place and therefore undesirable noises, the last mentioned construction has the additional drawback that there is resiliency in only one direction.

Moreover, it has been proved that the damping of transverse shocks and the exclusion of rocking phenomenons at the car body are the more effective, the lower the resilient bearings are arranged, i. e. the higher the centre of gravity of the car body is situated above the resilient bearings and, furthermore, the larger the angle is which is formed by the middle axes of the bearings arranged at both sides of the longitudinal middle plane of the vehicle, said middle axes being determined by the direction of smallest elasticity, the longitudinal axis of rotation of the car body being determined by the point of intersection of said middle axes of the bearings. This angle preferably amounts to at least 60° if possible, however, to 90–120° or more.

In the accompanying drawing one construction according to the invention is diagrammatically shown by way of example.

The rear wheels *a* are mounted upon oscillating half axles *b* which are linked to the casing *c* of the differential gear and the shocks of which are absorbed by a transverse leaf spring *d* (or unguided coiled springs) fixed to the casing. The upper surface of the casing *c*, serving as supporting body for the oscillating half axles, is provided with a curved bearing member *e* upon which the car body *f* is mounted by means of two or more plate- or ledge-like rubber buffers or rubber bearings *g*, extending in the longitudinal direction of the vehicle and arranged at both sides of the longitudinal centre plane of the vehicle spaced in as large a distance from each other as possible. The rubber buffers or rubber bearings *g* are arranged between the bearing member *e* and the car body in such a manner that the directions of their smallest elasticity intersect each other in a point 0 upon the road under an angle α of between 60° and 90°. The centre of gravity of the body is situated above the rubber bearings *g*.

A similar arrangement could also be provided for the front axles. However, the invention is of particular importance for gauge altering oscillating half axles. Moreover, the rubber bearings could be arranged between the car body and the chassis carrying the axles instead of between the axle aggregate or aggregates and the car body. Eventually the springs, for instance coiled springs, serving to absorb shocks acting upon the wheels, could bear against the car body.

Furthermore, the point 0 could also be situated below or above the plane of the road. Moreover, the rubber bearings could be constructed in any other desired manner, for instance so that a circular rubber plate extending over the entire bearing surface is interposed between the bearing member *e* and the car body. The construction shown, however, results in a particular favourable absorption of all forces and vibrations.

The rubber bearings may be constructed as rubber-metal-members or may be connected in any other suitable manner to the parts to be united.

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MAY 25, 1943.

BY A. P. C.

K. WILFERT ET AL

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THE CHASSIS OR AN AXLE AGGREGATE

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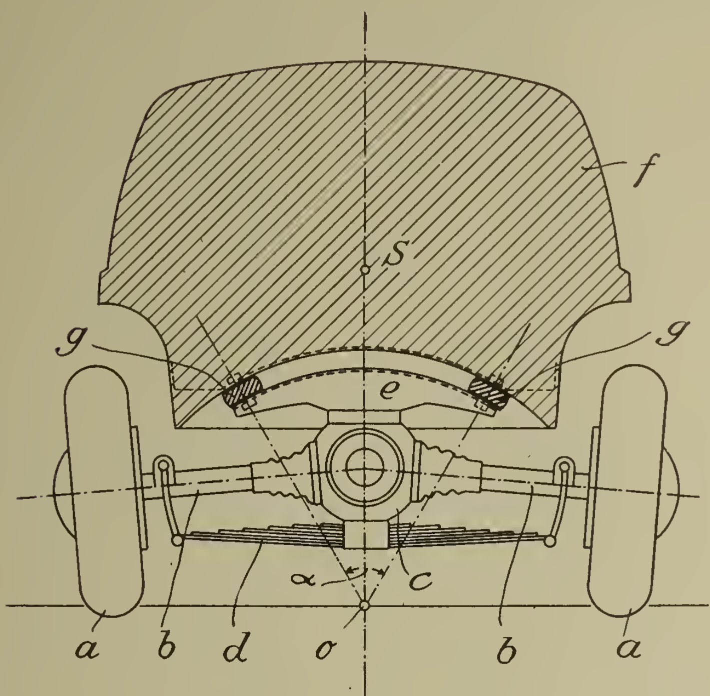

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ALIEN PROPERTY CUSTODIAN

CONNECTION OF A WHEEL SUSPENSION TO THE FRAME OR BODY OF A VEHICLE

Karl Wilfert, Sindelfingen, and Béla Barényi, Vaihingen-Rohr, Germany; vested in the Alien Property Custodian

Application filed October 8, 1941

The present invention relates to a connection of a wheel suspension to the frame or body of a vehicle (rest of the vehicle) which is resilient in a plurality of directions. More particularly, the invention is concerned with a resilient connection of a wheel suspension or an axle aggregate with the frame or the car body of a motor vehicle consisting substantially in this that, independent on the spring suspension of the wheel, resilient intermediate members are arranged between the members of the vehicle to be united which intermediate members effect a resiliency in directions different from each other, single or main ones. Preferably the intermediate members effecting resiliency in different directions are arranged one behind the other in the sense of the power transmission. The main directions of the various resiliencies, moreover, preferably extend vertically to each other at least as far as one or a portion of the intermediate members is concerned, particularly transversely to the direction of run (eventually also in the direction of run) on the one hand and on the other hand substantially in a vertical direction.

For the resilient connection rubber members of any suitable shape or also guided coiled springs may be used. The use of rubber sleeves is particularly to be recommended which always provide for a main resiliency in the direction of their axis only. By employing a plurality of sleeves arranged one behind the other and at an angle to each other, a substantial resiliency into two or more directions may, however, be obtained according to the invention, whereby a corresponding selection of the sleeves a larger resiliency in the one main direction may be allowed than in the other main direction.

For instance the wheel suspension or the axle aggregate, having a resiliency substantially acting transversely to the direction of run, may be mounted at at least one intermediate member which in turn is fixed to the frame or the car body with a substantially vertical resiliency. In the sense of the power transmission a reversed succession of the resiliency may be provided from the wheels or the axle respectively to the frame or the car body. The first mentioned arrangement, however, allows bearing of the springs, absorbing shocks acting upon the wheels, against the intermediate member in such a manner that the resilient members, for instance rubber sleeves, mainly effecting a resiliency in a transverse direction are not or in a reduced measure only stressed by the weight of the car body or the forces of the springs respectively.

In the accompanying drawing one construction according to the invention is shown by way of example.

In this drawing:

Fig. 1 shows a rear elevation of a rear axle, partially in section, and

Fig. 2 is a section on the line 2—2 of Fig. 1 (side elevation).

The rear wheels *a* are mounted upon oscillating half axles *b* which are linked to the casing *c* of the differential gear serving as axle support. Fixed to projections of the casing *c* are two upper transverse rods *d* and two lower transverse rods *e* the pivot-like ends of which are mounted by means of transversely arranged rubber sleeves *f* and *g* respectively in lateral tube-like projections of four vertical sleeves *h*. Each of these sleeves in turn is journalled by means of an upper rubber sleeve *i* and a lower rubber sleeve *j* upon a vertical pivot *m* fixed to the frame or to suitable members *k* and *l* respectively of the car body. The sleeves *h* may be arranged separately or connected together by transverse members to form a rigid unit. In the construction shown the two sleeves *h* provided at each side of the vehicle are rigidly connected to each other by connecting tubes *n*, the oscillating half axles *b* extending through the space between the sleeves and the connecting tubes. Each of the sleeves is provided with a spring bracket o against which bears a coiled spring *p* the lower end of which is fixed to a spring bracket *q* provided at the oscillating half axle. Eventually a single spring bearing against the upper connecting tube *n* could be used for instance.

As may be seen, the differential gear casing may yield together with the oscillating half axles *b*, the rear wheels *a* and the transverse rods *d* and *e* on the one hand substantially to the extent of the resiliency of the horizontal rubber sleeves *f* and *g* transversely to the direction of run, and on the other hand together with the sleeves *h* substantially to the extent of the resiliency of the vertical rubber sleeves *i* and *j* in a vertical direction, each of the rubber sleeves simultaneously allowing a resiliency, but indeed a small resiliency only, in an other direction also, so that a metallic contact of the individual members is obviated. However, it would also be sufficient, for instance, if the vertical rubber sleeves only would allow a resiliency into all directions, the horizontal rubber sleeves, however, exclusively a resiliency transversely to the direction of run. As the spring brackets *o* are provided at the sleeves *h* which with regard to the car

body may yield substantially in a vertical direction only, the rubber sleeves *f* and *g* are released to a substantial extent from the weight of the car body viz. from the forces to be transmitted by the springs *p* respectively, so that a weak resiliency of the axle aggregate in the transverse direction may be obtained.

In this case the use of non-guided coiled springs *p* is of particular advantage in so far as these springs, in spite of their bearing against members which are not movable in a transverse direction, offer practically no resistance to resiliency in a transverse direction.

By the combination of a resiliency in a transverse direction with a resiliency in a vertical direction as proposed according to the invention, oscillating phenomenons of the car body may be prevented in an effective manner by the use of simple and under working conditions reliable resilient intermediate members. The invention is of particular importance in connection with gauge altering oscillating half axles. The transverse shocks occurring on deflection of the springs of the wheels are absorbed first of all by the transversely arranged rubber sleeves. The vertical rubber sleeves simultaneously allow an advantageous resiliency of the axle aggregate about a longitudinal axis of the vehicle.

The invention may be used also in connection with other axle constructions, for instance front axles. Moreover, a resiliency according to the invention may eventually also be provided between the frame carrying the front- and rear-axles and the car body. Furthermore, a portion of the resilient intermediate members may have also a main resiliency in the longitudinal direction of the vehicle instead of, for instance, in the transverse direction or in a vertical direction or additionally to such resilient intermediate members. With such a construction principally the shocks acting in the direction of run may elastically be absorbed.

Preferably the rubber sleeves are adhesively connected to the pivots extending through them or to the metal sleeves enclosing them or to interposed metal sleeves serving for connecting purposes respectively. This may be done by vulcanisation. The connection, however, may be effected in any other suitable manner also. E. g. it would be possible to provide the rubber sleeve inside and outside with metal sleeves which are then connected to the parts to be elastically connected e. g. by means of screwing.

The invention may be applied to rigid axles, preferably to oscillating axles and more especially to oscillating half axles. It may be applied to one, more or all axle aggregates of a vehicle; this latter having one axle aggregate (trailer) or two or more axle aggregates. It is of course also possible to apply the invention to cars without a frame.

KARL WILFERT.
BÉLA BARÉNYI.

PUBLISHED

MAY 25, 1943.

BY A. P. C.

K. WILFERT ET AL

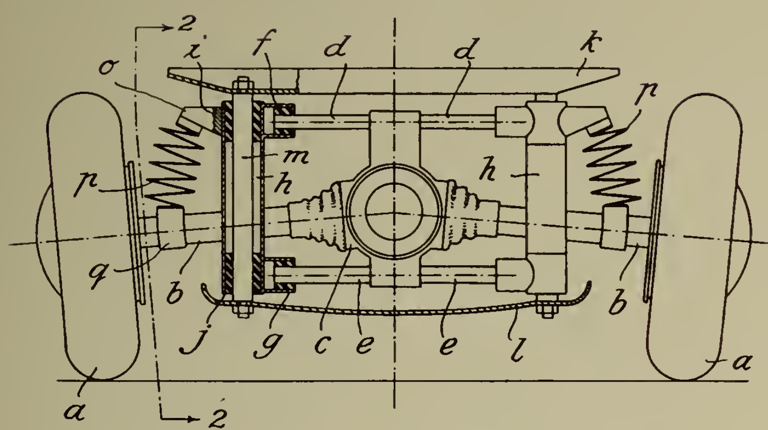
CONNECTION OF A WHEEL SUSPENSION TO THE FRAME OR BODY OF A VEHICLE

Filed Oct. 8, 1941

Serial No.

414,147

Fig. 1



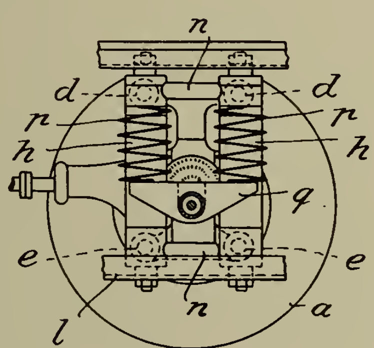


Fig. 2

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Published May 25, 1943

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ALIEN PROPERTY CUSTODIAN

WHEEL SUSPENSION FOR VEHICLES

Max Wagner, Stuttgart, Germany; vested in the Alien Property Custodian

Application filed October 15, 1941

This invention relates to improvements in wheel suspensions, more particularly by means of two links arranged one above the other and comprising a springing system by means of an unguided helical spring or of a likely mounted spring. One feature of the invention consists in that the spring bears by its one end against the casing of the shock absorber. In a particularly suitable embodiment, the casing of the shock absorber forms simultaneously the bearing support for a guiding link of the wheel, for instance for the upper link of the link quadrangle.

By this invention a particularly simple and advantageous supporting device of the wheel springing system is produced. According to the invention particular bearing supports mounted hitherto in the known arrangements for supporting the spring and secured for instance laterally with respect to the frame side member are suppressed, as the shock absorber, which is necessary without that, is employed for supporting the spring. Simultaneously by this means distortion stresses at the frame, which are produced by lateral arrangement of a spring support, are avoided.

Furthermore, if the casing of the shock absorber serves simultaneously as an abutment for guiding links a supplementary simplification of the construction is realized by suppressing a separate bearing upport. In this case the shock absorber, besides its proper function as a shock absorber, has simultaneously the function of supporting the guiding link and bearing the wheel springing system.

Furthermore this invention consists in that in a wheel suspension of the characterized manner, which against the action of springing buffers is capable of yielding a little essentially about a vertical axis, the spring by its one end bears against the oscillating part of the wheel suspension, advantageously against the lower link of a link quadrangle, and by its other end against a member supporting the wheel suspension system, said member itself not oscillating, but being only capable of yielding—with respect to the frame—in a limited manner essentially about a vertical axis. In this case too, the spring bears advantageously against a casing of the shock absorber forming simultaneously the bearing support for the one guide link and forming also part of the wheel suspension system capable of yielding about a vertical axis.

In the known arrangements executed in a similar manner, the helical spring was mounted in a vertical direction and—by its one end—bearing against the lower guiding link capable of yielding about the vertical axis and—by its upper end—against a bearing support fixedly secured to the frame. By this means, lateral relative displacements of the lower end of the spring with respect to the upper end of the spring were produced, these displacements producing lateral stresses of the spring in a supplementary manner. By this invention the said lateral stresses of the spring are avoided, both ends of the helical spring bearing against bearing surfaces, which only together are capable of yielding about a vertical axis. By this means lateral relative displacements are suppressed. Furthermore the advantage is realized that by the springing system no immediate torque stresses of the frame are produced. On the contrary, all the stresses due to the wheel can be transmitted to the frame only by the vertical trunnion, i. e. at a point, where the frame without that possesses a greater rigidity.

The invention is illustrated in the accompanying drawing, the Figures 1 and 2 of which showing two embodiments thereof.

In the drawing, *a* represents a lateral tubular frame side member of a vehicle, *b* a cross member, for instance likewise of tubular form and which connects together the two lateral frame cross members. In a tubular sleeve *c* vertically passing through the frame side member *a* at the point of connection between the latter and the cross member, is disposed a trunnion *d* capable of oscillating about a vertical axis. At the top of the trunnion passing beyond the frame side member is disposed a casing *e* of a shock absorber or damper, for instance of a dashpot type shock absorber, in such a manner that the shock absorber reaches beyond the outside of the frame side member and eccentrically with respect to the oscillation axis. In the casing of the shock absorber is disposed—by means of a bolt *f* passing through the casing of the shock absorber and operating the same in an adequate manner—an upper link *g* for a wheel bearing member *h* resp., for a steering swivel pin of the wheel. The lower link *i* for guiding the wheel is fixed on the underside of the vertical trunnion by means of the pivot *k*.

An arm *l*, which bears in both directions of rotation against rubber buffers mounted on the cross member *b*, serves for elastically supporting the trunnion *d* about its vertical axis.

The springing of the wheel is provided by means of an unguided helical spring *n*, which, by its underside immediately or for instance by insertion of a bearing support supported itself, by means of a ball joint, bears against the lower

guiding link c and by its upper end against a collar o of the casing e of the shock absorber. The supporting parts of the end of the spring may be fixedly connected for instance by means of lock members. The most it is sufficient however that the supporting ends of the spring are secured against lateral displacement. Furthermore, inside the helical springs there may be provided rubber buffers or similar stops limiting the upward stroke of the wheel and eventually likewise the downward stroke.

In the embodiment of Fig. 1 the cylinder p of the shock absorber screwed into the casing e serves simultaneously for securing the upper end of the helical spring against lateral displacement.

In the embodiment of Fig. 2 however, the damping cylinder p is arranged outside the helical spring, so that the cylinder resp. the damping piston may be removed and replaced independently of dismounting the helical spring.

MAX WAGNER.

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MAY 25, 1943.
BY A. P. C.

M. WAGNER
WHEEL SUSPENSION FOR VEHICLES
Filed Oct. 15, 1941

Serial No.
415,007

Fig. 1.

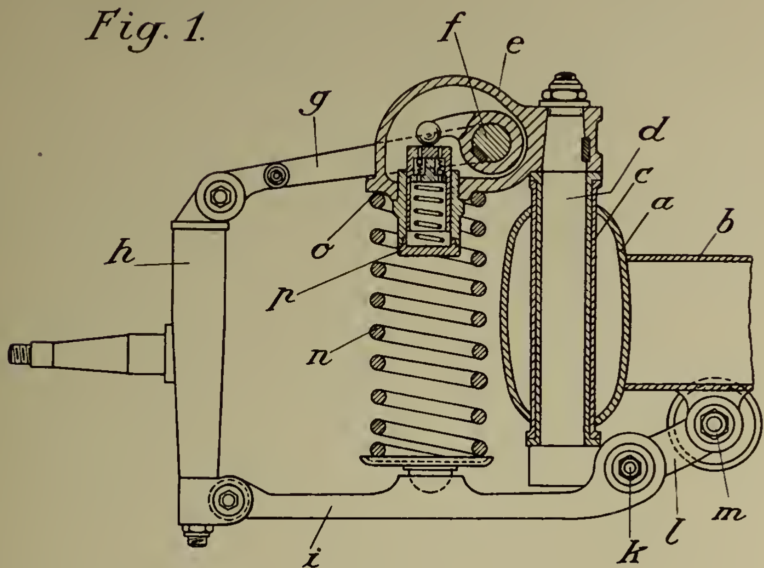
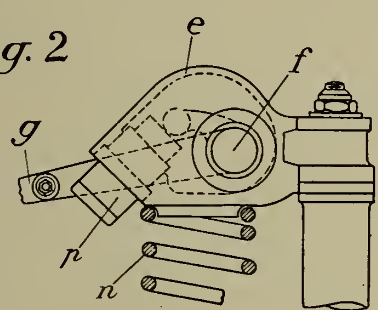


Fig. 2



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Published May 25, 1943

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ALIEN PROPERTY CUSTODIAN

BRIDGING MATRIX FOR ENDLESS SOUND BANDS AND METHOD OF PRODUCING SUCH BANDS

Hugo Westerkamp, Koln-Poll, Germany; vested in the Alien Property Custodian

Application filed October 29, 1941

The invention relates to a method of producing endless sound bands with several sound tracks running parallel to the edge of the band and being mechanically reproducible, and to a device for carrying out this method.

It is known to produce endless sound bands of said kind by connecting the ends of a bounded sound band with the aid of a bridging matrix. The known method proposes to produce the bridging matrix from the original sound band, before a pressing or stamping matrix is made of the original. In most cases, this cannot be carried out, because the sound record on the original sound band is completely destroyed in the part from which the bridging matrix has been produced.

According to the invention, the ends of the bounded sound band with a number of parallel sound tracks produced by a pressing or stamping process are cononected by means of a bridging matrix which has been produced from the original sound band or from a copy thereof.

Advantageously, the bridging matrix is obtained by producing patrices from the ends of the original matrix, which patrices are cut, fitted together, soldered, and engraved with continuous sound tracks, and from the one piece obtained in this manner, the bridging matrix is produced, for example, by a galvanoplastic moulding process.

This bridging matrix may be manually brought to engage the sound tracks at the ends of the duplicated bounded sound band, which ends are fitted together or are arranged so as to overlap each other for the purpose of being connected, whereupon the sound grooves at each end are brought into engagement with the corresponding sound ribs of the bridging matrix. But this bringing into engagement is rather difficult and in order to make it easier, the original sound band is provided, according to the invention, on both sides of the cut part outside the sound track bundle with marks, for example in the shape of grains, which are formed in producing the pressing matrix and the bounded sound band made from this matrix as well as in producing the bridging matrix, the marks formed on the ends of the sound band being brought to engage the corresponding marks formed in the bridging matrix when connecting the ends of the sound band.

An example of the method according to the invention is diagrammatically illustrated in the accompanying drawing, in which:

Fig. 1 shows an endless original sound band constituting the starting material for the method according to the invention. The original sound band consists, for example, of a wax band, i. e. a carrier layer covered with a wax layer, into which a sound groove is continuously cut in known manner, this sound groove having a length amounting to a plurality of the length of the sound band and running parallel to the edge of the band. 1 is the carrier layer of the original sound band, 2 is the wax layer, and 3 is the sound groove cut into the wax layer.

From the endless original sound band there are produced bounded sound bands in series by stamping, pressing, casting or the like by means of a matrix. For this purpose, the endless original sound band is cut for example at 4 so as to obtain a bounded band, from which is made, for example by a galvonoplastic process, a bounded original matrix 5 (Fig. 2) serving to produce a not illustrated bounded patrix which, on the other hand, serves to produce a bounded pressing or stamping matrix.

By cutting the endless original sound band, the sound tracks 3 have been interrupted; the cutting of the original sound band, and especially the production of the matrix and of the patrix, result in a small loss of the band and, consequently, in a loss of a part of the sound record so that, when the ends of the sound bands produced in series are fitted together, the associated sound tracks will not exactly run in the same lines any more. But it is absolutely necessary that the sound tracks should run exactly in the same lines so as to prevent the reproducing needle from jumping out of the sound track or entering another sound track.

In order to prevent this, the ends of the sound band are connected according to the invention by means of a bridging matrix which is produced in the following manner:

Patrices are produced from each of the ends *a* and *b* of the original matrix 5 (Fig. 2), for example by a galvanoplastic process; these two patrices are shown at 6 and 7 in Fig. 3. The edges of the ends of the band 5, originally irregular, owing to the galvanoplastic production, are advantageously cut straight before being placed in the glavanic bath. The parts 6 and 7 of the patrices are then aligned with the sound tracks, fitted and soldered together. The aligning is advantageously effected by means of an optical magnifying method. After the parts 6 and 7 of the patrix have been soldered together or connected in some other manner so as to form one piece, the sound tracks, though aligned, being still separated by the soldering place or the like, are

connected by engraving connecting tracks so as to obtain continuous sound tracks. Fig. 4 shows the connected parts 6 and 7 of the patrix with one half of the sound tracks connected by engraved connecting tracks and the other half of the sound tracks still separated by the soldering place or the like.

Thereupon the connected parts 6 and 7 of the patrix are used to produce, also by a galvanoplastic process, a pressing or stamping matrix 8 (Fig. 5) which represents the desired bridging matrix.

The ends of the bounded sound band produced in series, for example by a pressing or stamping process, are now fitted together on the bridging matrix in such a manner that the sound grooves on the ends of the band engage the corresponding parts of the ribs of the bridging matrix, as far as fitting parts exist on the two ends of the band, on the one hand, and on the bridging matrix, on the other hand. This bringing into engagement, may be effected manually. The free ends of the band are advantageously cut sloping according to the original separating line 4 (Fig. 1) and are, preferably chamfered, brought to overlap each other, as illustrated in Fig. 6, in which the bridging matrix is again marked 8 and the ends of the band are marked 9 and 10. By applying heat and pressure, the ends of the band are combined by means of a stamp 11 so as to form an endless band. In this combining process, the connecting lines of the sound grooves, engraved manually in the production of the bridging matrix, are pressed into the material of the sound band, so that the endless sound band is also provided with uninterrupted sound grooves at the connecting place.

The bringing into engagement of the sound grooves at the free ends of the band in its bounded form with the sound ribs of the bridging matrix is difficult and requires much time. In order to facilitate this operation, the endless orignal sound band is provided, according to the invention, on both sides of the cutting place 4 outside the sound track bundle with marks, which are moulded in the production of the pressing matrix and of the bounded sound band made therefrom as well as in the production of the bridging matrix. The marks may, for example, consist of grains in the wax layer of the original sound band. In Fig. 1 there are indicated on the right of the cutting place 4 three grains 12, and on the left of the cutting place three grains 13. In the original matrix 5 (Fig. 2), these grains are represented by projections 12′, 13′, and in the sound band produced in series they are again in the shape of hollow grains. On the other hand, the original grains form projections in the bridging matrix, so that it is easy, by inserting these projections in the corresponding grains in the free ends of the sound band, to bring the sound ribs of the bridging matrix into engagement with the sound grooves in the free ends of the sound band, which is thus effected automatically.

HUGO WESTERKAMP.

PUBLISHED

MAY 25, 1943.

BY A. P. C.

H. WESTERKAMP

BRIDGING MATRIX FOR ENDLESS SOUND BANDS AND METHOD OF PRODUCING SUCH BANDS

Filed Oct. 29, 1941

Serial No. 417,027

Fig. 1.

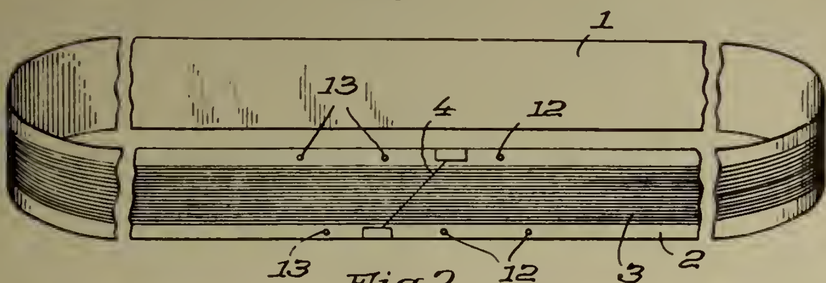
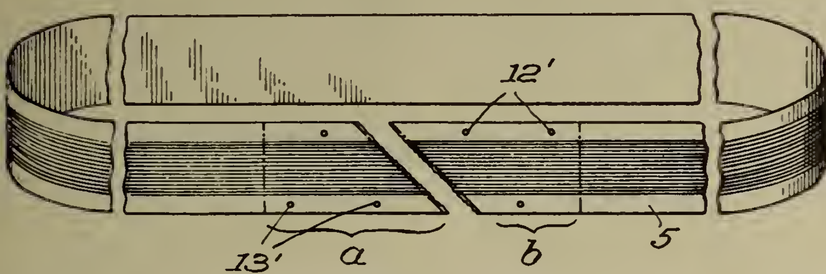


Fig. 2.



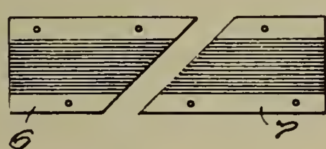


Fig. 3.

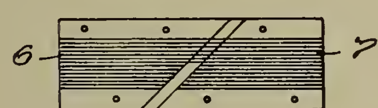


Fig. 4.

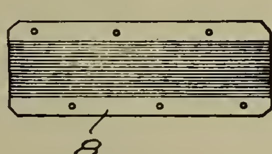
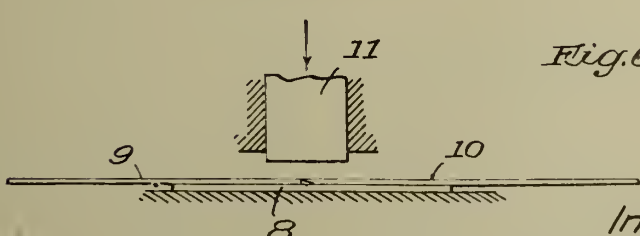


Fig. 5.

Fig. 6.



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Published May 25, 1943

Serial No. 416,424

ALIEN PROPERTY CUSTODIAN

PRODUCING A WASHING AGENT AND DETERGENT

Ernst Schubert, Jonsdorf, near Zittau, and Heinz Pierer, Zittau, Germany; vested in the Alien Property Custodian

No Drawing. Application filed October 24, 1941

The present invention relates to a method of producing a washing agent and detergent and particularly is concerned with the manufacture of a washing agent and detergent and with this washing agent and detergent itself.

The method according to the invention consists in adding water soluble lignine transformation products, particularly the extraction—and treatment—products respectively (alkali lignine) obtained by the treatment of lignine with aqueous alkali solutions or salt solutions to a washing agent and detergent, for instance a soap in liquid, semi-solid or solid form in the conformation of for instance cakes, flocks or powders which may be free of or contain filling materials. or to other washing agents and detergents which at least partly are composed on an organic basis, particularly such washing agents and detergents which contain fatty acid salts and may contain other substances, for instance salts, oxidyzing means, inorganic substances. as for instance waterglass, whereby preferably the content of the washing agent on fatty acid salts and organic washing agents respectively is reduced.

As is well known, the hitherto used washing agents and detergents have drawbacks, which with washing agents containing relatively small amounts of organic substances only and for instance contain chemicals having a bleaching effect consist in this that the washing and purifying effects are not satisfactory and accompanied by damages inflicted on the fabric, whereas the soaps, for instance the soap powders, possessing good wetting and emulsifying efficiencies, have a washing effect free of objections, have, however, the drawback of forming lime soaps when used in hard water.

The washing agent and detergent according to the present invention which is characterized by a content on water-soluble lignine products, particularly alkali lignine, is free of these drawbacks. An addition of alkali lignine of 20 to 25% to a washing agent and detergent of the above mentioned kind results in an excellent washing effect without harmful action upon the textile material even then if the washing agent contains relatively small amounts of fatty acid salts and this without presenting the drawbacks which are due to the formation of lime soaps.

The water-soluble lignine transformation products, particularly alkali lignine, act as so-called protecting colloids, so that the use of same prevents losses on fatty acids by the formation of lime soaps. The addition of water-soluble lignine transformation products, particularly alkali lignine, to washing agents the content of fatty acids of which is relatively small, amounts, for instance, to 20% only, is of special importance.

According to the invention preferably the portion of fatty acid is reduced as far as possible in the manufacture of a washing agent and detergent. Harmful effects inflicted on the washing action as well as on the wetting and emulsifying efficiency are not to be feared and automatically washing agents of a bleaching character may be used without damaging the textile material, a definite amount of such agents must, of course, not be exceeded.

With particular advantage alkali lignine transformation products are used in accordance with the invention which may be obtained by known methods. For instance, a product resulting from the wood hydrolysis which represents a mixture of various substances and is called lignine may be treated with an aqueous soda lye or a potash lye or other alkaline reacting solutions until all soluble substances are solved. The treatment may be effected in the heat, for instance by boiling, and pressure may be applied. Then the solution is decanted from the non solved residue. The solution contains the alkali lignine. From this solution solid alkali lignine may be obtained by evaporation and/or salting out. The alkali lignine solution itself, eventually after compressing, may be used for the method of the invention.

According to the invention washing agents and detergents may be obtained which are easily and clearly soluble in water up to 30° DH and have an excellent washing effect.

Example 1

5 parts of anhydrous lignine are shaked for a short period of time with 5 parts of a solution of potassium hydrate of 20%, filled up to 250 parts by means of preliminary heated water and boiled for a short period of time. The bottom sediment is filtered off after standing. The alkali lignine is dried, for instance, by evaporation and 25 parts of this alkali lignine are added to 75 parts of a soap scrap product of a fatty acid concentration of 80% to be had on the market.

Example 2

A soap powder of the following concentration: 21.8 parts of soap scraps, 22 parts of sodium carbonate, 15 parts of sodium sulphate (Glauber's salt) is added to 22.5 parts of alkali lignine and adjusted with water to 100%. The alkali lignine was obtained by treatment of the residue, remaining in the production of sugar from wood, with

the same quantity of a concentrated potassium sulphide solution at boiling temperature, filtering off of the insoluble residue, mixing the filtrate with sodium bicarbonate, separating off of the liquid, eventually compressed, and drying. The washing- and detergent-action is good and no harmful effect is exerted upon the textile material.

The treatment of the lignine may also be effected by boiling under pressure with a potash lye of 20%.

Example 3

To 20 parts of an alkyl- or aryl-ester of sulphuric acid and higher molecular fatty acids, 15 parts of sodium carbonate, 8 parts of sodium perborate, 24 parts of an alkali lignine are added which were obtained in the following manner: 15 parts of anhydrous lignine were stirred with 28 parts of ammoniac of 40% for several hours, shortly heated under pressure and cooled after release of the pressure. The solution was salted out with sodium sulphate and the precipitated alkali lignine was used. Moreover, 4 parts of waterglass and 14 parts of sodium sulphate were added and adjusted to 100% with water. The product has an excellent automatic washing effect without local oxygen dissociation and harmful effects upon the washed material.

ERNST SCHUBERT.
HEINZ PIERER.

Published May 25, 1943

Serial No. 416,566

ALIEN PROPERTY CUSTODIAN

PNEUMATIC DRIVE OF THE GYROSCOPES ON BOARD AIRCRAFT

Charles Raymond Waseige, Rueil, Seine-et-Oise, France; vested in the Alien Property Custodian

Application filed October 25, 1941

The gyros of board instruments are presently driven by low pressure air. A pump, usually driven by the engine, sucks air off a sealed casing of the gyro; this casing comprises an injection nozzle through which air from the outside enters under the influence of the depression produced by the suction of the pump, the jet being suitably directed onto the blades of the gyro so as to ensure its rotation. The depression or the pressure differential necessary between the outside and the inside of the casing to secure the normal run of the gyro amounts to about 130g. It will thus be readily apparent that at high levels, when the ambient atmospheric pressure falls to low values, this depression can only be obtained with much difficulty, even with a pump having a good efficiency.

It has been suggested to utilize the delivery of a volumetric pump of the vane type blowing into the gyro nozzle, the casing being connected with the open air. This solution requires however the provision of a perfect oil purifier in order to free the air from the oil used to lubricate the pump, inasmuch as the board instruments cannot resist to the gumming caused by impurities carried by the air delivered by the pump.

This invention relates to combinations of means aiming to provide a flow of air under pressure by means of a pump, the air thus delivered being entirely free from impurities, more particularly from oil droplets.

The invention consists essentially in that those driving and bearing members of the pump which require to be lubricated are arranged in a first sealed casing while the air pulsating members of the same pump are arranged in a second casing having no communication whatever with the first casing. The shaft of the pump proper is thus supported in the first casing, while it is overhanging and free from bearings in that casing through which the entrained air flows.

Means are further provided in order to prevent oil particles from running along said shaft extending from the drive casing to the air pulsating casing.

According to one embodiment, the two casings are separated by an open space.

In the case of a centrifugal pump, the roll gearings and the driving gear wheels of the impeller are mounted in the lubricated casing, the impeller itself being mounted upon an overhanging part of its shaft and free from bearings in the pump casing proper.

In the case of a volumetric pump of the vane-type, the driving gear wheels are mounted in the lubricated casing while the vanes, mounted upon overhanging parts of the shafts of said wheels, rotate in the pump casing without any bearings and without lubrication.

A pump of this type, electric drive being assumed, may be located in the neighbourhood of the board instruments, thus doing away with long piping and losses of head.

In the case of a stratospheric airplane having a sealed cabin, the pump, located inside the cabin, sucks off the air at a pressure higher than the ambient pressure, which allows the use of a pump of smaller volume for a given capacity in weight of air.

Other features and advantages of this invention will moreover be apparent from the following description of various embodiments shown, solely by way of an example, on the annexed drawings in which:

Fig. 1 is a sectional view of a centrifugal pump according to the invention.

Fig. 2 is a section on the line II—II of Fig. 1.

Fig. 3 is a sectional view of a volumetric pump of the vane type.

Fig. 4 is a section on the line IV—IV of Fig. 3.

Fig. 5 is an end view of Fig. 3, the casing cover being removed.

Fig. 6 is a fragmentary plan view of the pump of Figs. 3, 4 and 5.

The centrifugal pump shown in Fig. 1 is driven by an electric motor which is provided with a cooling device comprising a small turbine **1** keyed on the rotor shaft **2** and which, by means of gear wheels **3** and **4**, operates the shaft driving the centrifugal pump impeller, the pump shaft being supported by two roll bearings **5**, **6**. An oil retaining ring **7** is provided for sealing the gear casing, and a gasket **8** is provided for sealing the same casing relatively to the electric motor.

The gear case is separated from the pump body by an air gap **9**, the two casings being connected together by means of lugs **10**, **11**, **12** and **13**. The impeller **14** of the centrifugal pump is preferably of the closed conduit type.

Fig. 2 is a sectional view in a plan between the gear case and the pump proper, showing the free space around the impeller driving shaft.

The high speed electric motor drives the impeller, preferably at an elevated speed, through a suitable train of gears, the air being admitted through the inlet **33** and delivered through the outlet **34** to the conduit leading to the instrument gyros.

The air thus delivered enters under a suitable pressure into an injection nozzle of the apparatus,

The jet of air is directed upon the blades of conventional type carried by the gyro and rotates the latter. The centrifugal pump proper operates on air free from oil since it is distinctly separated from the gear case, the gear wheels of which require oiling. The air delivered by the pump is thoroughly dry, thus avoiding the gumming of the board instrument members which would be detrimental to the satisfactory working of the same.

Fig. 3 shows a two-vane pump driven by an electric motor **15**. One vane, **17**, is directly driven by said motor through a splined sleeve **16**. This vane is mounted upon a shaft **18** which is carried in the casing **19** by means of bearings **20**, **21**. The other vane, **22**, is driven by the shaft **23** and the gears **24**, **25**. Its shaft is also supported at some distance by bearings **26**, **27**. The case containing the gears and bearings supports the vane shafts and is separated from the pump casing proper as shown by the space **28**. This gear case is sealed by oil retaining rings of conventional design.

The lugs **29**, **30**, **31** and **32** connecting the pump and gear casings together are shown in Fig. 4.

Fig. 6 shows the connecting lugs **31**, **32** and the open gap **28** around the vane shafts.

The driving gears and bearings may thus be lubricated, the two casings being distinctly separated from each other. The vane pump proper operates without any lubrication and delivers dry air under a suitable pressure for the same purpose as indicated relatively to the centrifugal pump or any other purpose.

The invention is in nowise limited to the embodiments shown and described as these are given only as an example.

The gyros of board instruments are presently driven by low pressure air. A pump, usually driven by the engine, sucks air off a sealed casing of the gyro; this casing comprises an injection nozzle through which air from the outside enters under the influence of the depression produced by the suction of the pump, the jet being suitably directed onto the blades of the gyro so as to ensure its rotation. The depression or the pressure differential necessary between the outside and the inside of the casing to secure the normal run of the gyro amounts to about 130 g. It will thus be readily apparent that at high levels, when the ambient atmospheric pressure falls to low values, this depression can only be obtained with much difficulty, even with a pump having a good efficiency.

It has been suggested to utilize the delivery of a volumetric pump of the vane type blowing into the gyro nozzle, the casing being connected with the open air. This solution requires however the provision of a perfect oil purifier in order to free the air from the oil used to lubricate the pump, inasmuch as the board instruments cannot resist to the gumming caused by impurities carried by the air delivered by the pump.

This invention relates to combinations of means aiming to provide a flow of air under pressure by means of a pump, the air thus delivered being entirely free from impurities, more particularly from oil droplets.

The invention consists essentially in that those driving and bearing members of the pump which require to be lubricated are arranged in a first sealed casing while the air pulsating members of the same pump are arranged in a second casing having no communication whatever with the first casing. The shaft of the pump proper is thus supported in the first casing, while it is overhanging and free from bearings in that casing through which the entrained air flows.

Means are further provided in order to prevent oil particles from running along said shaft extending from the drive casing to the air pulsating casing.

According to one embodiment, the two casings are separated by an open space.

In the case of a centrifugal pump, the roll gearings and the driving gear wheels of the impeller are mounted in the lubricated casing, the impeller itself being mounted upon an overhanging part of its shaft and free from bearings in the pump casing proper.

In the case of a volumetric pump of the vane-type, the driving gear wheels are mounted in the lubricated casing while the vanes, mounted upon overhanging parts of the shafts of said wheels, rotate in the pump casing without any bearings and without lubrication.

A pump of this type, electric drive being assumed, may be located in the neighbourhood of the board instruments, thus doing away with long piping and losses of head.

In the case of a stratospheric airplane having a sealed cabin, the pump, located inside the cabin, sucks off the air at a pressure higher than the ambient pressure, which allows the use of a pump of smaller volume for a given capacity in weight of air.

Other features and advantages of this invention will moreover be apparent from the following description of various embodiments shown, solely by way of an example, on the annexed drawings in which:

Fig. 1 is a sectional view of a centrifugal pump according to the invention.

Fig. 2 is a section on the line II—II of Fig. 1.

Fig. 3 is a sectional view of a volumetric pump of the vane type.

Fig. 4 is a section on the line IV—IV of Fig. 3.

Fig. 5 is an end view of Fig. 3, the casing cover being removed.

Fig. 6 is a fragmentary plan view of the pump of Figs. 3, 4 and 5.

The centrifugal pump shown in Fig. 1 is driven by an electric motor which is provided with a cooling device comprising a small turbine **1** keyed on the rotor shaft **2** and which, by means of gear wheels **3** and **4**, operates the shaft driving the centrifugal pump impeller, the pump shaft being supported by two roll bearings **5**, **6**. An oil retaining ring **7** is provided for sealing the gear casing, and a gasket **8** is provided for sealing the same casing relatively to the electric motor.

The gear case is separated from the pump body by an air gap **9**, the two casings being connected together by means of lugs **10**, **11**, **12** and **13**. The impeller **14** of the centrifugal pump is preferably of the closed conduit type.

Fig. 2 is a sectional view in a plan between the gear case and the pump proper, showing the free space around the impeller driving shaft.

The high speed electric motor drives the impeller, preferably at an elevated speed, through a suitable train of gears, the air being admitted through the inlet **33** and delivered through the outlet **34** to the conduit leading to the instrument gyros.

The air thus delivered enters under a suitable pressure into an injection nozzle of the apparatus. The jet of air is directed upon the blades of conventional type carried by the gyro and rotates the latter. The centrifugal pump

proper operates on air free from oil since it is distinctly separated from the gear case, the gear wheels of which require oiling. The air delivered by the pump is thoroughly dry, thus avoiding the gumming of the board instrument members which would be detrimental to the satisfactory working of the same.

Fig. 3 shows a two-vane pump driven by an electric motor **15**. One vane, **17**, is directly driven by said motor through a splined sleeve **16**. This vane is mounted upon a shaft **18** which is carried in the casing **19** by means of bearings **20**, **21**. The other vane, **22**, is driven by the shaft **23** and the gears **24**, **25**. Its shaft is also supported at some distance by bearings **26**, **27**. The case containing the gears and bearings supports the vane shafts and is separated from the pump casing proper as shown by the space **28**. This gear case is sealed by oil retaining rings of conventional design.

The lugs **29**, **30**, **31** and **32** connecting the pump and gear casings together are shown in Fig. 4.

Fig. 6 shows the connecting lugs **31**, **32** and the open gap **28** around the vane shafts.

The driving gears and bearings may thus be lubricated, the two casings being distinctly separated from each other. The vane pump proper operates without any lubrication and delivers dry air under a suitable pressure for the same purpose as indicated relatively to the centrifugal pump or any other purpose.

The invention is in nowise limited to the embodiments shown and described as these are given only as an example.

While I have described what I at present consider preferred embodiments of my invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the spirit and the scope thereof.

CHARLES RAYMOND WASEIGE.

PUBLISHED

MAY 25, 1943.

BY A. P. C

C. R. WASEIGE

PNEUMATIC DRIVE OF THE GYROSCOPES ON BOARD AIRCRAFT

Filed Oct. 25, 1941

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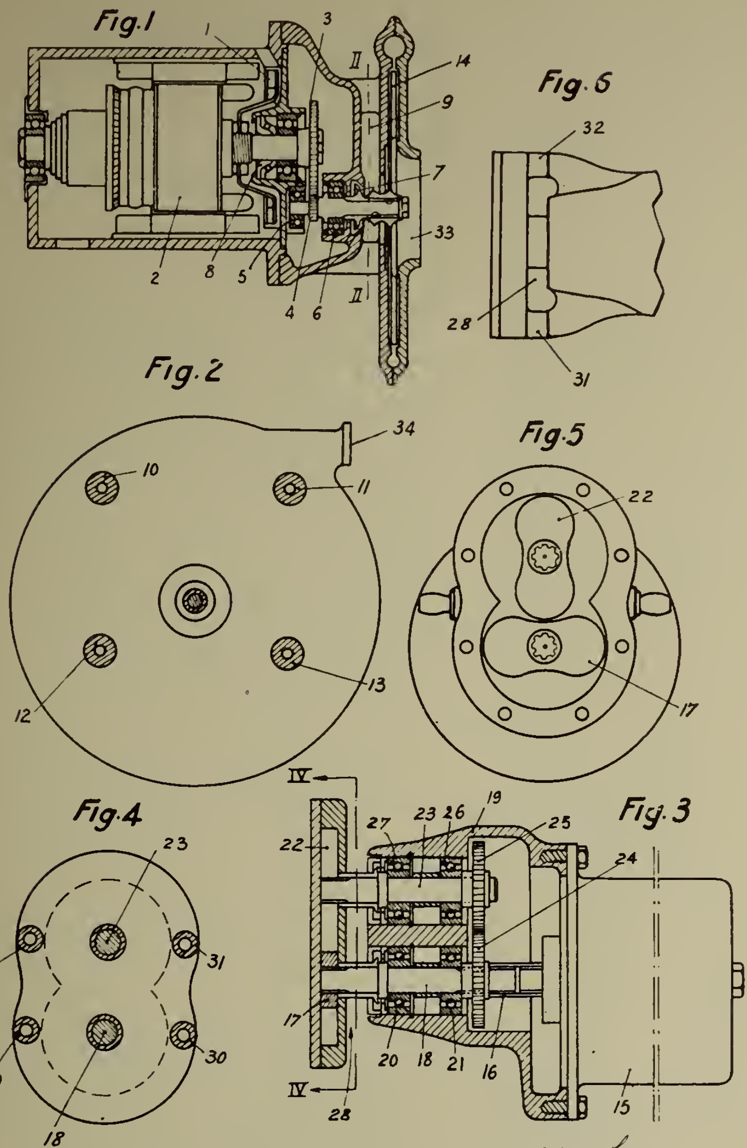

Inventor,
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ALIEN PROPERTY CUSTODIAN

APPARATUS FOR RECORDING OF RAPIDLY VARYING PROCESSES

Ernst Jacobi, Oslo, Norway; vested in the Alien Property Custodian

Application filed October 28, 1941

The invention concerns an apparatus for recording of rapidly varying processes. Many of the rapidly varying processes which shall be recorded are of electrical nature. Others which are difficult to subject to direct recording can be converted to electrical quantities so as to be more conveniently registered. In all these cases it is sufficient to consider a voltage dependent on the measured quantity which will be dealt with in the following.

The hitherto known appliances for recording of voltage, provided with recording needle and based on the revolving-drum principle, are by reason of their slowness of adjustment suitable only for measurement of slowly varying voltages. The efforts to attain an acceleration of the adjustment have led to curtailment of the time of adjustment for a complete amplitude down to 230 milliseconds.

Georg Neumann's "Pegelschnellschreiber," which like the afore-said revolving-drum appliances, writes a directly visible record on paper, attains a shorter adjustment time of 150 milliseconds for a complete amplitude.

For the cathode-ray oscillograph the time of adjustment is, it is true, reduced to nil, but to render the record visible, it is necessary to develop photographic sensitized paper or film. The photographic processes demand much time and are rather expensive.

The subject of the present invention is an appliance which records only disconnected momentary voltage values in directly visible writing at intervals corresponding to less than 10 milliseconds. The intervals between the registrations are so short that the voltage curves obtained are sufficiently near to the form of an unbroken line for many scientific and technical purposes. The characteristic features of the apparatus according to the invention consists therein that the recording of the measured quantity takes place in accordance with the time that elapses until a varying voltage in co-operation with a voltage dependent on the measured quantity has acquired a particular value.

An illustrative example of the principle of measurement according to the invention is given in Fig. 1. A wheel R, provided with one or more recording pins, rotates over a band B of litmus-paper or similar material moving in the direction of the axle of the wheel. The paper is given a cylindrical shape, so that the recording pins on the wheel touch upon the band of paper over almost its entire breadth. The pressure of the recording pins on the paper is met by a counter-pressure from a likewise cylindrically shaped metal plate M, so that an electrical current can flow through the paper between the recording pins and the metal plate.

This current is produced by a tension generated at the secondary terminals for a transformer *Tr*. The current through the primary coil of the transformer *Tr* arises as a discharge from the condensor C1 via a thyratron T. The condenser C1 is loaded via a resistance W2 from a source of energy E1. The cathode *k* of the thyratron is connected with the minus-pole for the voltage E*x* which is to be measured, while the grid *g* of the thyratron is connected with the plus-pole for the voltage E*x* which is to be measured, via the potentiometer P, where the grid acquires a variable negative preliminary voltage through the slide-brush S. Current is conveyed to the potentiometer P from the source of energy E3

It is now only necessary to bring about a synchronism between the movement of the recording pins of the wheel R and the slide-brush S. This is effected by a suitable gearing between the two cogwheels Z1 and Z2. Care must be taken that at the moment when the recording pins of the wheel R touches the paper B the potentiometer shall supply the grid with maximum preliminary negative voltage.

The process of measurement is effected as follows: According as the recording pin pursues its course over the band of paper, the slide-brush moves from one point of contact on the potentiometer to the next and so on, whereby the negative voltage on the thyratron grid is steadily diminished. Not until this negative voltage in the grid becomes sufficiently small will the grid-voltage, which is composed of this preliminary voltage and the momentary value of the voltage that is to be measured, attain the value which will bring the thyratron to ignition. At this moment the condenser C1 will discharge itself via the transformer *Tr*, thus bringing about a colouring of the paper at the point thereon which corresponds to the height of the preliminary voltage or to the height of the voltage which is to be measured.

Through this arrangement any desired form of graduation scale can be selected. According to the dimensioning of the resistances there can be produced a linear, a logarithmic or an irregular form of scale.

Assuming that the apparatus, as already mentioned, records one point at intervals of 10 milliseconds, i. e. 100 points per second, a frequency

of 10 periods can be recorded with sufficient accuracy. By recording 1000 points per second, about 100 periods can be registered.

For measurement of alternating voltages one can in known manner—as shown in the drawing—employ a current rectifier, for example by means of a duodiode with a combination of a resistance W4 and condenser C3. In such case the peak-voltage curve is measured. It is advisable to make the time-constant for this combination a little greater than the time-interval between two registrations.

By such an apparatus there can also be measured almost simultaneously voltages of different origin, if—for instance—there is placed on the axle of the wheel R*a* commutator which alternately connects the terminals of E*x* with different sources of energy.

Such an instrument can be used, for instance, for registering the degree of modulation in a wireless telephone-sender, where not only the amplitude of the modulating voltage, but also the amplitude of the bearing wave is of importance for preventing overcontrolling. Therefore the 1st, 3rd, 5th pins etc. are used to record the modulating voltage, while the 2nd, 4th, 6th etc. record the voltage of the bearing wave.

The difference between these voltages can also be constantly attached to the terminal E*x*. The sender is then correctly operated, if the short-time peak-voltages of the modulation never exceed the voltage of the bearing-frequency. The difference between these voltages must never exceed the 0-limit. In case this 0-limit should nevertheless be exceeded by mistake in operation, which is just what is intended to record, it is expedient to displace the 0-point in the scale by use of an adjustable, but during the measurement constant preliminary grid-voltage.

Instead of being recorded chemically by use of litmus paper, the voltages may also be registered by perforation of the paper by passage of an electric spark. It will then be serviceable to give the recording pins a preliminary voltage through a condenser.

Fig. 2 shows another possible form of execution for the invention. Here the wheel R, the paper ribbon B, the metal plate M, the transformer T*r*, the condenser C1 and the source of energy E1 are arranged as in the mode of execution shown in Fig. 1. Likewise the cathode *k* of the thyratron T is connected with the minus-pole of the voltage E*x* which is to be measured. However, the diminishing negative grid-voltage is not produced by means of a potentiometer with rotating slide-brushes, but in the following manner: Through the resistance W3 there flows a current from the source of energy E2 to charge the condenser C2. Thereby is created through the resistance W3 with the negative side at the thyratron grid a preliminary grid-voltage which during the course of a charging of the condenser diminishes in logarithmic form. The condenser C2 can be discharged through the short-circuit switch S.

Synchronism between the movement of the recording pins of the wheel R and the opening of the switch S must be established. It must be ensured that the switch S opens when a recording pin touches the paper and that the switch closes shortly after the pin has left the paper. Several parallelly situated switches or other coupling methods may also be employed.

The process of measuring takes place as follows: When the recording pin comes in contact with the paper, the switch S opens. The maximum preliminary voltage through the resistance W3 is diminished simultaneously with the movement of the pin over the breadth of the paper. Not until the preliminary negative grid voltage is sufficiently small will the grid voltage which is composed of this preliminary voltage and the momentary value of the voltage that is to be measured reach the value which brings the thyratron to ignition. The rest of the process takes place as described in connection with Fig. 1. The form of the scale for the arrangement according to Fig. 2 is logarithmic. A linear form of scale can, as is known, be attained by means of a pentode.

ERNST JACOBI.

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MAY 25, 1943.

BY A. P. C.

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APPARATUS FOR RECORDING OF RAPIDLY VARYING PROCESSES

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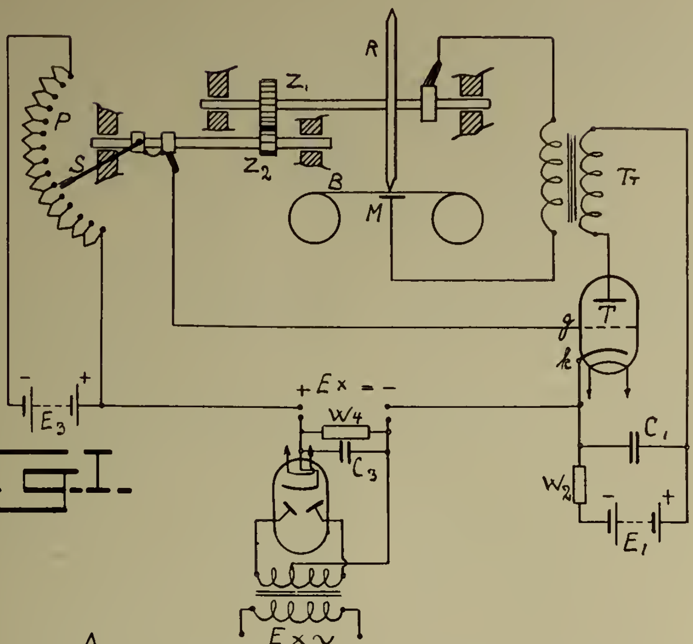

Fig. 1.

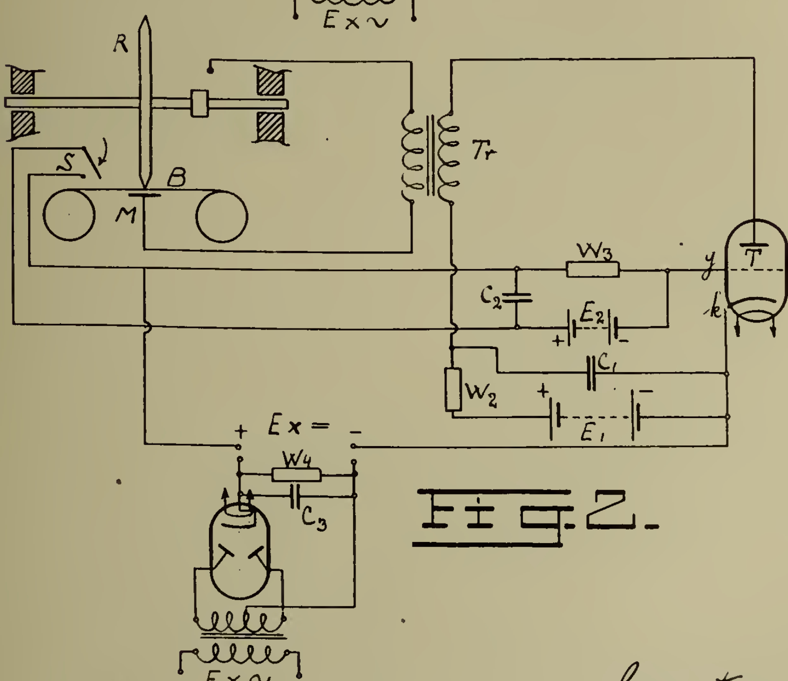

Fig. 2.

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ALIEN PROPERTY CUSTODIAN

CATHODE RAY TUBE

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Application filed November 3, 1941

The invention relates to cathode ray tubes, especially for television or oscillographic purposes, and more particularly of the type provided with a control electrode for influencing the intensity of the cathode ray beam.

Tubes of the kind heretofore used suffer from several disadvantages. Usually, the control electrode has the shape of a cylinder surrounding the cathode nearly completely and closed at its end by an apertured diaphragm. In this embodiment of the known type of cathode ray tubes, the capacity between the control electrode and the surrounding elements, especially the cathode, is by far too large for enabling the tube to be operated at high oscillation frequencies.

In these and other embodiments of known tubes, the cathode further is often supported by a centering member closely fitting round the cathode body. By this arrangement a considerable heat dissipation is involved and the requirement of heating power accordingly is comparatively high.

It is an object of the invention to provide a cathode ray tube wherein the capacity between the control electrode and the neighbouring elements is minimised.

It is another object of the invention to reduce the heat dissipation from the cathode body.

It is a further object of the invention to facilitate the manufacture of the electrode assembly and to shorten the axial length of the tube.

According to the invention, the control electrode has the shape of a small apertured disc or diaphragm and is mounted in a central recess of a ring-shaped centering member of insulating material which is closely fitted in and supported by the one end of a cylindrical electrode, while the cathode projects from the outside into the centering member to face the control electrode.

The invention will be better understood with the aid of and further features of the invention will be apparent from the following more detailed description and accompanying drawing, which in a purely diagrammatic fashion and by way of example illustrates a cross-section of the socket portion and of the cathode ray producing system of a tube according to the invention.

In the drawing, 1 is the equipotential body of a cathode bearing the emissive substance 2 at its front surface and adapted to be indirectly heated by the filament 3. The cathode body 1 is carried by a supporting member 4 which is fastened to a ring-shaped member 6, preferably by means of a glass bead 5. The surface of the joint between the cathode body 1 and the supporting member 4 is made as small as possible in order to reduce the heat conduction from the cathode. For the same purpose the member 4 may be shaped as a rod or wire of comparatively small cross-section.

The member 6 may consist of ceramic material, pressed glass, or preferably, burnt steatite. The control electrode indicated by 7 has the shape of a small apertured disc or diaphragm and is mounted in a central recess of the centering member 6.

The opening of the member 6, at the upper end of this element and along the greater part of its axial length, is preferably cylindrical and has a diameter which is considerably larger than that of the cathode body 1. At the base of the centering member the diameter of its opening is substantially equal to that of the cathode body, so that but a small play is left between the centering member 6 and the cathode body 1, just sufficient for pushing the cathode body through. Preferably, the opening of the annular member 6 has a narrowing towards its lower end, and the narrow portion of the member 6 is limited to a very short part of its axial length.

By this means the heat conduction from the cathode to the centering member is minimised, and stray electrons can hardly manage to penetrate into the discharge space.

The position of the control diaphragm 7 is further secured by a lead-wire 8 passing through a slit of the centering member 6. Preferably, the conductor 8 is fastened to the member 6 by means of a further glass bead 9.

The centering member 6 is closely fitted in the lower end of a cylindrical electrode 10 and may be secured to this electrode by a glass bead (not shown in the drawing) connecting the two elements.

It is advantageous to use the member 6 at the same time as a spacing means. This feature can be realized in a particularly simple manner when, as it is usual, the control electrode 7, in the direction of the electron movement, is followed by a first anode diaphragm 11 mounted within the cylinder 10. In this case it is merely necessary to shape the member 6 in such a way that the correct position of the control electrode 7 and the diaphragm 11 with respect to one another is obtained, when the member 6 is just closely adjoining to the diaphragm 11. In more general cases the member 6 may be provided with a flange or shoulder to fix its correct position with respect to the cylindrical element 10.

The electrode assembly as described above is

preferably supported by and fixed to supporting rods 14 and 15 as indicated in the drawing. In a preferred embodiment of the invention the supporting rods 14 and 15 are directly embedded in the socket portion 12 of the tube envelope which is formed by a base plate consisting of pressed glass. The base plate 12 may be sealed to the bulb portion 13 of the tube envelope by means of a glass flux 19. Further supporting rods pressed in the glass base may be provided for supporting other elements of the electrode system, which are not illustrated in the drawing.

Preferably, at least a part of the supporting rods passes through the base disc 12 and is provided at the ends outwardly projecting from the base disc with socket pins or similar contact pieces 16 so that the supporting rods at the same time can be used as lead-in conductors. In the example illustrated by the drawing, the supporting rod 14 is at the same time the lead-in conductor for the cylindrical electrode 10. In this case, insulation between the cathode 1 and the electrode 14 may be required, which can easily be obtained, for example by making the supporting member 14 at least partly of insulating material. The supporting rod 15 is used as the lead-in conductor for the control potentials.

Additional lead-in rods 17 are provided if necessary. The lead-in rods are also directly embedded and pressed in the glass flux of the base plate 12. As shown in the drawing, the lead-in rods 17 serve for supplying the cathode filament 3 with the heating current. Intermediate conductive strips 18, preferably consisting of elastic metal, may be provided.

Preferably, the materials of the lead-in or supporting rods and the glass base 12 are selected to have the same heat expansion coefficient. Likewise, care should be taken that the heat expansion coefficients of other metallic elements, for example the cathode 1, the control electrode 7, the cylinder 10, and the diaphragm 11, are substantially equal to the heat expansion coefficients of the adjoining insulating elements, for example the centering member 6.

It may be stressed once more that the drawing is purely diagrammatic and not on scale. Especially the distance between the cathode body 1 and the base plate 12 is considerably smaller and can be reduced in practical embodiments of the tube according to the invention to a few millimetres. By the way a remarkably short length of the tube system is obtained.

In the manufacture of a tube according to the invention it is advantageous to proceed as follows: With the aid of a spacing and centering means the cathode body 1 and the control electrode 7 which are already provided with their supporting members 4 and 8, are brought into their correct position with respect to the centering member 6. The assembly is secured by means of the glass beads 5 and 9 and the auxiliary spacing and centering means are removed. This structural unit is slipped into the cylinder 10. Hereafter the heating element 3 may be introduced into the cathode body 1.

The lead-in and supporting rods are directly embedded in the molten glass flux of the base disc 12 during the pressing process of the latter. The electrode assembly is mounted on the base member and the single elements are fixed to their supports and connected to their lead-in conductors, preferably by soldering in vacuo.

The base portion carrying the electrode system is then sealed to the glass envelope by means of the glass flux 19 which preferably consists of a molten glass powder applied to the bulb portion 13.

Further steps of the process which are not mentioned in the above, for example degassing and evacuating the tube, may be carried out in any known fashion. Further, it need not be mentioned that the complete electrode system of the tube may comprise electrodes, for example wall coatings and similar elements, which are not supported by and conducted through the base portion of the tube.

KLEMENS OHL.

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K. OHL

CATHODE RAY TUBE

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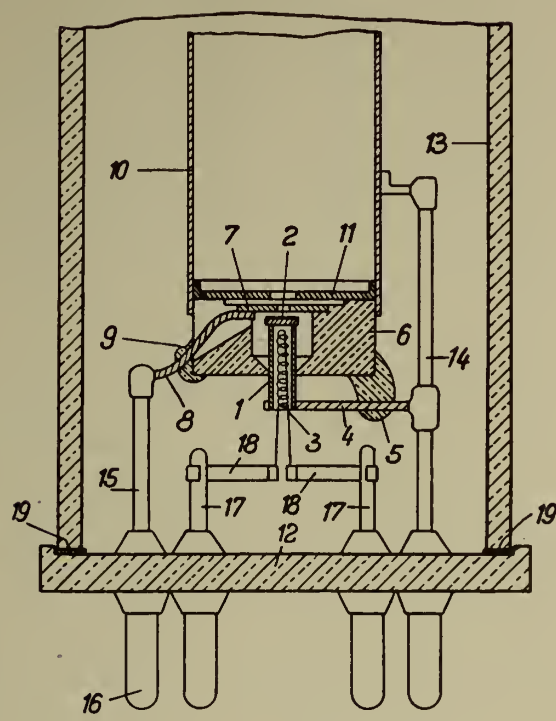

Inventor:

Edmund Ohl

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ALIEN PROPERTY CUSTODIAN

PISTON COUPLING

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Application filed November 12, 1941

This invention relates to improvements in piston couplings in connection with piston engines, more especially compressors.

In piston engines, for instance, compressors having a piston working in one direction and being permanently subjected during working to the action of a force tending to shift the piston away from its dead space outwards, it is well known to connect this piston with the engine element taking up this force, for instance, with another piston or a piston rod, by means of a "shape-joint" connection (i. e. a joint effected by the peculiar shape of the parts to be connected in such a manner that their parts are held together against forces acting in any of two opposite directions) leaving to the piston with respect to the other engine element a movability across the direction of the stroke, and moreover a certain play in the direction of the stroke. Such connection acts in normal working under the influence of the permanent force like a bare force-joint connection (with which two bodies by an external force are kept in permanent contact with each other, whereas they are allowed to separate from each other in the absence of the action of this force). The force-joint connection allows the piston to follow readily any displacement of the axis of its cylinder with respect to the direction of stroke of the other engine element. The completion of this force-joint connection to a shape-joint connection is intended to maintain the conjunction between the piston and the other engine element also in the case that the force effecting the force-joint, for instance, the gas pressure produced in the preceding stage acting upon the compressor piston of a higher stage, is absent or is yet too small. This, for instance, is the case when a multistage compressor in order to facilitate starting firstly pushes out the aspired gas without increasing the pressure or when the engine containing such piston is to be brought by hand into a determined position (for instance, starting position) or is to be moved in an idle course. As a rule this shape-joint connection is only compelled to take up the relatively small force of the friction of the piston.

In the well-known arrangement a piston rod penetrating the piston with radial play is provided carrying abutments which engage the piston at its front ends leaving a slight play in the direction of the stroke. The abutment adjacent the working space of the piston is formed as a screw-nut capable of being removed in the direction toward the working space. In this case the cavity receiving the piston rod which is open toward the two front sides must be tightened against the working space. For this purpose a shut-off cap covering the end of the piston rod is screwed upon the end of the piston opposite the working space. This especial shut-off member is inconvenient inasmuch as it increases the member of elements and complicates the disconnection of the joint, because it must be previously released from the piston.

The object of the present invention is to provide a connection of a single acting piston with another engine element which in normal working acts as a bare force-joint connection and in which at the same time a shape-joint with a certain play across the direction of stroke and in this direction is provided, which connection is further of simple shape and composed of a few parts, and may be readily disconnected, especially without previous removal of shut-off members tightening against high pressure.

According to the invention the connection is constructed in such a manner that the part of the shape-joint connection taking along the piston in the absence of the force-joint during the outward stroke can be removed from the piston in a direction other than that toward the working space, i. e. either laterally or away from the working space.

If the member of the shape-joint connection taking along the piston can be laterally removed from the latter, a most simple configuration and manipulation of the connection results provided that the elements of the force-joint connection as well as the elements completing this connection to a shape-joint connection are arranged wholly outside the piston on its side remote from the working space.

If the part of the shape-joint connection taking along the piston during the outward stroke can be removed from the piston in a direction away from the working space, all elements of the joint may be positioned inside the cavity of the piston. The elements completing the connection to a shape-joint connection are in this case advantageously shaped to form a thread- or bayonet-joint so that they can be separated from one another by turning and axially displacing the piston with respect to the other part of the engine. In this case there is further required a safety member preventing this relative turning motion during working which however is not encumbered by the forces acting on the piston. After releasing this safety member the joint may be at once disconnected.

With this construction of the joint according

to the invention the piston needs no bore toward the working space, so that also removable members for closing such bores are dispensed with. The connection is consequently simpler and safer and can be disconnected more easily and more rapidly than the construction heretofore used.

The invention will now be more fully described with the aid of the annexed drawings of which

Figs. 1, 2, 3, 4, and 8 show connections the elements of which are positioned outside the piston;

Figs. 5, 6 and 7 show connections the elements of which are positioned inside the piston.

Figs. 1, 4, 5, 6, and 8 are longitudinal axial cross-sections, partly in elevation;

Fig. 2 is a cross-section on the line II—II of Fig. 1;

Fig. 3 is a plan view corresponding to Fig. 1;

Fig. 7 is a cross-section on the line VII—VII of Fig. 6.

Referring first to Figs. 1, 2, and 3, 1 is a cylinder having a working space 2 in which the piston 3 connected by force-joint with the piston rod 4 reciprocates. The latter is provided for this purpose with an end face 10 against which the head 11 of a stem 12 fixed in the piston 3 bears with its slightly convex end face 13 under the pressure existing in the space 2. To complete this force-joint connection to a shape-joint connection the head 11 of the stem 12 is provided with an annular recess 15 whereas the end of the piston rod 4 opposite the piston 3 contains a cavity 16 open at one side, the inwardly projecting front wall 17 engaging the recess 15. When in the absence of pressure in the working space 2 the piston rod 4 is displaced in the direction of the arrow a, i. e. to the left, the front wall 17 takes along the head 11 of the stem 12 and therewith the piston 3. Between the head 11 and the cavity 16 sufficient play is provided to preserve the possibility of freely adjusting the piston 3 in view of the piston rod 4, should the faces 10 and 13 come in contact (force-joint position).

For being disconnected the piston 3 is first wholly withdrawn out of the cylinder 1 by means of the piston rod 4 and then displaced across its axis so that the head 11 gets entirely clear of the cavity 16 of the piston rod 4. In the same simple manner the connection may be reestablished.

Fig. 4 shows the connection between a smaller piston 3 and a greater piston 33. The hub of the greater piston 33 presents an even cross-face 20 against which the smaller piston 3 bears with the convex end face 21 of its frontal projection 22. For establishing a shape-joint connection two lugs 34, 35 are provided at the hub of the greater piston 33 overlapping the projection 22 of the smaller piston. A screw-bolt 25 is passed through a cross-bore 24 in the projection 22 and the lugs 34, 35 and secured by screw-nuts. For inserting the bolt 25 a threaded bore is provided in the jacket of the piston 33 which may be closed by a screw-plug 36. The lugs 34, 35 and the bolt 25 may be given sufficient play in view of the projection 22 and the bore 24 respectively, to permit of free adjustment of the piston 3 in view of the piston 33 during working.

For disconnection both pistons are withdrawn out of their cylinders, then the nuts of the bolt 25 are removed, and finally the bolt 25 is withdrawn out of the bore 24 in the projection 22.

In the modification shown in Fig. 5 the piston 3 touches with a convex abutment face 31, only a little projecting from its bottom, an even cross-face 30 of a piston rod 37 secured to a greater piston 33. To establish a shape-joint connection, an inner thread 38 is provided in the jacket of the piston 3, and an outer thread 39 is cut on the piston rod 37. After screwing into each other the threads, the parts 3 and 37 are fixed with respect to each other in circumferential direction by a screw 27 penetrating both parts in radial direction in such a manner that the threads which have a radial and axial play in view of each other permit of the free adjustment of the piston 3 in view of the piston rod 37, when the force-joint connection is effective, i. e. when the face 30 touches the face 31.

For being disconnected both pistons are withdrawn out of their cylinders, the safety screw 27 is released and then the piston 3 is unscrewed from the piston rod 37.

The example illustrated in Figs. 6 and 7 differs from that shown in Fig. 5 by the fact that the members effecting the shape-joint connection are formed according to the bayonet-joint principle. The piston 3 carries at its front end remote from the dead space two inwardly directed arcuate projections 41, 42 leaving passages 43, 44 between their ends. On the other hand, the piston rod carries two diametrically opposed projections 45, 46. When being composed the two parts 3 and 37 are in such relative angular position that the projections 45, 46 can be passed through the recesses 43, 44. After being passed the two parts 3 and 37 are turned about each other through 90° and secured in this position by screw bolts 28 radially penetrating both parts. Hereby the shape-joint connection is established. The projections 41, 42 and 45, 46 have when face 30 touches face 31 sufficient play against one another to warrant the free adjustment of the piston 3 in view of the rod 37.

The disconnection is effected by the reversed manipulations.

In the modification shown in Fig. 8 an intermediate member 55 is inserted between the piston 3 and the piston rod 4, which member has the form of a hollow sphere on one side and is even on the other side. The hollow sphere engages a spherical projection 53 of the piston 3, whereas the plane face is in contact with the even cross-face 50 of the piston rod 4, whereby both parts 3 and 4 are allowed to freely undergo parallel and angular displacements, and at the same time the transmission of forces over large faces is permitted. For establishing a shape-joint connection the even abutting face is formed on a peculiar body 60 which may be secured to the piston rod 4 and is provided with an outwardly projecting shoulder 61. This shoulder is engaged by a collar 56 of the prolongation of a union-nut 57 screwed upon the projection 53 of the piston 3 provided with the spherical face 51, which union-nut serves for holding the intermediate member 55 on the spherical face 51. The body 60 is secured, after applying the union-nut, to the piston rod 4, for instance, by means of a nut 62 positioned in a cavity 63 of the piston rod and being accessible from the outside. After the union-nut has been screwed upon the thread of the projection 53, the shape-joint connection between the parts 3 and 4 is established. The disconnection is simply effected by unscrewing the union-nut 57 from the projection 53 of the piston.

The male thread receiving the nut may also be provided on the piston rod 4, and the body 60 engaged by the nut 57 and provided with the shoulder 61 may be secured to the piston 3.

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BY A. P. C.

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PISTON COUPLING

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418,664

2 Sheets-Sheet 1

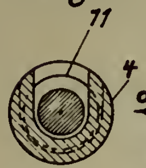

Fig.2

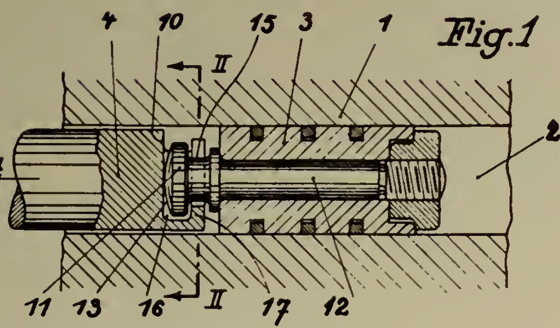

Fig.1

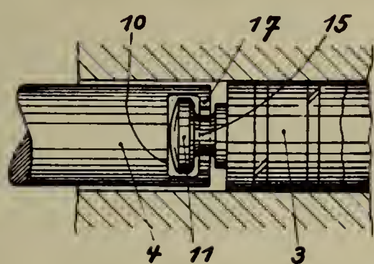

Fig. 3

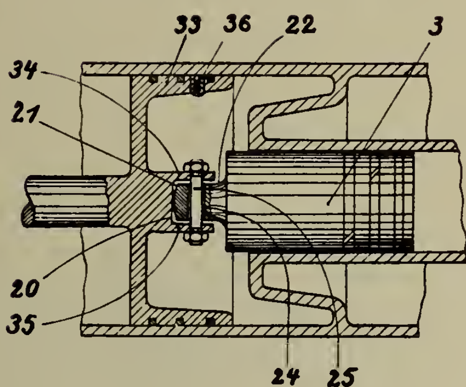

Fig. 4

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Serial No. 418,664

2 Sheets-Sheet 2

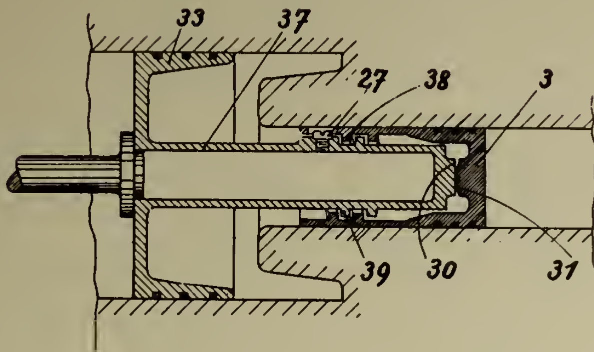


Fig. 5

Fig. 7

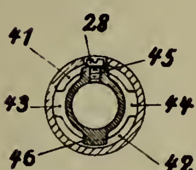


Fig. 6

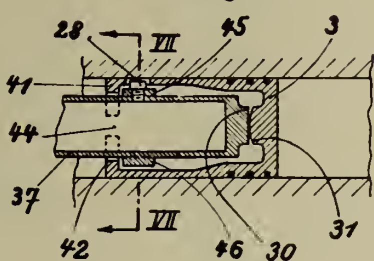
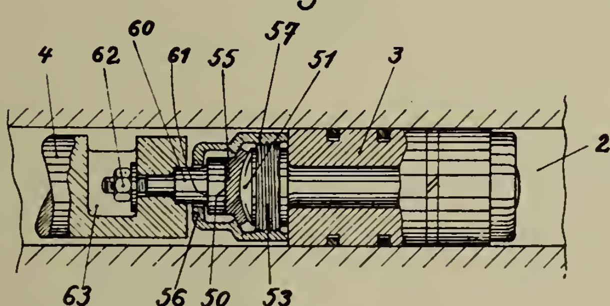


Fig. 8



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ALIEN PROPERTY CUSTODIAN

DYNAMIC MULTIPLIER

Rolf Colberg, Berlin-Lichterfelde, and Friedrich Michels, Berlin-Zehlendorf, Germany; vested in the Alien Property Custodian

Application filed November 12, 1941

The invention relates to secondary emission multipliers. There exist two groups of secondary emission multipliers. The so called "static" multipliers are provided with a plurality of secondary emission electrodes having each a constant potential increasing with the distance from the cathode. Each electron is multiplied only once at each electrode of the multiplier. The "dynamic" multipliers on the other hand contain usually only one or two secondary emission electrodes. They are operated with an alternating potential in such a manner that one and the same electrode is impacted several times by secondary electrons emitted by the same or another electrode. Each of the electrodes has the same potential along its surface in each instant.

The invention relates to a type of multiplier including features of both above mentioned classes of multipliers. The arrangement may be called a dynamic multiplier because it operates with only one or two secondary emission electrodes having an alternating potential. It has however in common with the known static multipliers that the electrons are guided after each impact in a new direction so that they move along a predetermined path through the arrangement.

In the dynamic multipliers as hitherto used, the electrons move in groups but they fill practically the whole discharge space between the electrodes and are not confined to prescribed electrons paths. In the arrangement according to the invention however they move along well defined paths. This has the advantage that the maximal current intensity is dependent only upon the number of electrons impacting upon the last secondary emission electrode because the electrons are not mixed with those electrons coming from an earlier secondary emission stage. In consequence thereof the difficulties existing in usual dynamic multipliers as for instance the production of undesired oscillations are overcome. It has been impossible furthermore to obtain a concentrated output-stream of electrons directed towards relatively small anodes. The output electron-stream may be directed towards a diaphragm and used in any appropriate manner.

It has been suggested to produce the repeated impact of electrons upon a single secondary emission electrode by a suitable choice of the variable potential applied to the electrode. These so called multipactors operate with an alternating potential having a "long period." The period of the alternating potential is long in comparison to the transit-time of an electron on its flight through the discharge space. The multiplication is obtained during the increasing portion of the alternating potential period by making use of the fact that the electrode has acquired a higher potential after each transit-time of the electron so that the electrons impact upon the same electrode but each time with a higher velocity, so that new secondary electrons are liberated. During the descending portion of the alternating potential no multiplication takes place.

The multiplier of the invention has two series of electrode-elements arranged opposite to one another and all elements of each series have one and the same potential. According to the invention the electrode-elements are connected with one another in each series. In front of each secondary emission electrode there is arranged an accelerating electrode including in its interior a space free from electrical fields.

Other aspects of my invention will be apparent or will be specifically pointed out in the description forming a part of this specification, but I do not limit myself to the embodiment of the invention herein described, as various forms may be adopted within the scope of the claims.

Referring to the drawing Fig. 1 shows a longitudinal section through the tube according to the invention, Fig. 2 shows a view of the secondary emission electrode confining the discharge space and Fig. 3 shows a number of diagrams for explaining one mode of operation of the tube.

The tube 1 of Fig. 1 contains two secondary emission electrodes 2, having each a number of concavely curved portions connected by substantially flat portions. The electrodes 2 are arranged opposite to one another so that the curved portions form two series of impacting surfaces having a uniform potential. Preferably the two oppositely arranged electrodes 2 are connected by metallic walls enclosing the discharge space on both sides of the device. The electrode formed by these parts has therefore the shape of a closed chamber or cell having an input-opening for the light or for electrons and an output-opening at the other end of the chamber. An accelerating grid 3 is arranged parallel to the electrodes 2. A similar grid may also be arranged in front of the lateral side-walls of the chamber and has for instance the form of a wide mesh wire-screen consisting of wires of 0.1 mm and one mesh per mm. The screen may also be replaced by a number of parallel wires lying parallel to the plane of the section of Fig. 1. A mirror is built into the tube so that light falling in the direction of the dotted arrows upon the mirror is reflected upon the first portion of the secondary emission electrode as indicated by broken lines. An output-electrode or anode 6 is arranged at the opposite end of the multiplier and connected by way of the resistance 9 to the positive pole of a source of D. C. potential, the negative pole of which is connected by way of a source of A. C. potential 7 to the electrode 2.

The potentials are chosen in such a manner that the period of the alternating potential is

large in comparison to the time of flight of an electron through the discharge space from one curved portion of the secondary emission electrodes 2 towards the opposite curved portion. The potential of the source 8 is larger than the amplitude of the A. C. potential so that the accelerating electrode 3 is always positive against electrode 2. The anode 6 and the accelerating electrode are separately brought out of the tube. They have however the same D. C. potential. These two electrodes may be connected within the tube and in this case a larger output-current is obtained. The output-capacity is at the same time increased so that it may be preferable to use a separate output-connection.

In the operation of the tube the photo-electrons emitted by the upper left portion of electrode 2 are accelerated by the positive potential of electrode 3 in the direction of the lower left portion of electrode 2. In consequence of the concave curvature of the photo-electrode the electrons are bundled so that they impact upon the opposite portion of electrode 2 at a relatively small area. The paths of the electrons in this first stage are indicated by arrows 14. During the ascending portion of the alternating potential the electrode 2 becomes more positive during the transit-time of the photo-electrons, so that the electrons impact upon this electrode with a velocity sufficient to liberate a number of secondary electrons. This operation is repeated in the direction of the next curved portion of the oppositely arranged electrode and so on until the electrons are drawn away from the right upper element in the direction of the anode 6 having an area of 1 cm^2 or less. It is a special advantage of the arrangement that the electrons impact upon the electrodes under a small angle, so that a particularly large number of secondary electrons is emitted. It may be preferable to arrange the accelerating electrodes at a somewhat larger distance in front of the secondary emission electrode, so that the accelerating field is effective during a longer portion of the time of flight of the electrons. In the space between the grids 3 no acceleration takes place.

The arrangement of Fig. 1 can be replaced by an arrangement represented in Fig. 2. In this case the secondary emission electrode has the form of a screw-surface. The form of the electrode is produced by rotating and at the same time moving an elementary section of electrode 2 in axial direction. The accelerating grid 3 may be inserted into this chamber by screwing a preformed grid into the device and by fastening it in an appropriate manner. Also in this case the surface impacted by electrons may be curved concavely against the discharge space in order to produce a concentrating effect upon the electrodes.

As the electrode is nearly completely closed towards the outside, it may be preferable to employ the electrode as a portion of the wall of the high vacuum-tube. The tube is then a metal tube having substantially the form of Fig. 2 provided at the ends with insulating portions carrying the connecting leads and the window for the entrance of light.

The operation of the tube has been described in accordance with the method used in multipactors. It is however possible to operate the tube with an alternating potential the period of which is equal to the time of flight of an electron through the discharge space or to an integral fraction of this time. Fig. 3*a* shows in a diagram two portions of electrode 2 lying opposite to one another and designated with reference numerals 12 and 22. These electrodes have the same potential. The accelerating grid is designated with 13 and 23. Figs. 3*b* to 3*e* shows the potential of electrode 12 and 22 as a function of the location of an electron moving from electrode 12 to electrode 22. While the electron travels from electrode 12 towards electrode 22, the potential of these electrodes changes in accordance with the values represented in the curves. If now the tube is operated with a sinus potential the period of which is equal to the transit-time of the electrons, the electrons are accelerated between the electrodes 12 and 13, if the point of zero-potential is taken as starting point. The section 10 only of the sinus potential is used, because after that time the electrons enter the space between grids 13 and 23 free from accelerating fields. Behind the screen 23 the second acceleration in the portion 11 takes place because in the meantime the alternating potential has reversed its direction and the potential of secondary emission electrode 22 is against on its ascending portion. This operation can be considered as a special case of the method of the long period.

The operation can be improved by employing in accordance with Fig. 3*c*, an A. C. potential having none-sinusoidal form in which the extreme values of the potential are situated more towards the beginning and the end of the period. This form is best represented by Fig. 3*d* in which two impulses of opposite direction are employed.

Another manner of operation is that with an alternating sinus potential of Fig. 3*e* in which the time of flight of the electrons is an integral multiple of the period of the alternating potential. From the foregoing description it can be seen that the positive half-wave at the beginning of the oscillation and the negative half-wave at the end of the train of oscillations is made use of while the intermediate half-waves are ineffective, because the electron starting with the beginning of the first half-wave is moving through the space between grids 13 and 23 during these intermediate half-waves. This is however only true for electrons beginning their flight at the beginning of the first period. It is however clear that after one full period the same conditions are present for new electrons so that now a new group of electrons is accelerated and enters the space between the grids. This is again repeated during the third half-period so that n groups of electrons are moving in the space between two electrodes 12 and 22, if the period of the alternating potential is equal to $1/n$ of the time of flight. The efficiency of this device will therefore be high particularly if always one half-wave corresponds to the time of flight within the accelerating space. It is also possible to make the arrangement in such a manner that the time of flight between electrodes 12 and 13 is smaller or larger than a half-wave and that it corresponds for instance to a quarter-wave, in which case the portion of the time of flight corresponding to positive portions of the wave must be larger than the portion corresponding to negative half-waves, so that an acceleration is obtained.

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BY A. P. C.

R. COLBERG ET AL
DYNAMIC MULTIPLIER
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FIG. 1

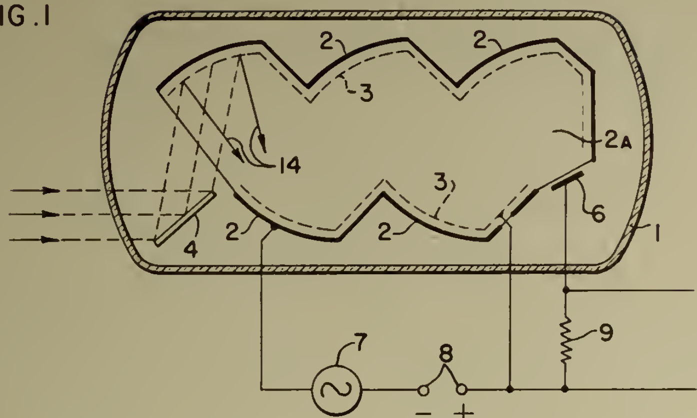


FIG. 2

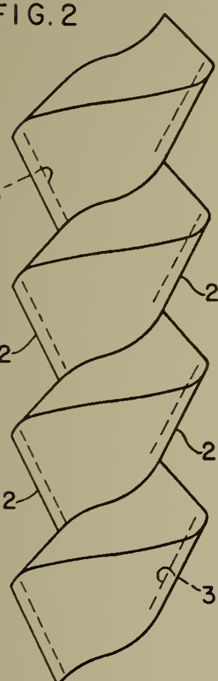
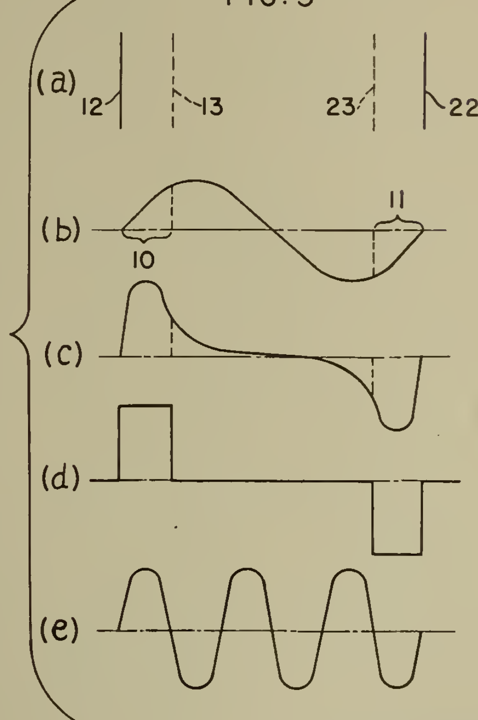


FIG. 3



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Published May 25, 1943

Serial No. 418,762

ALIEN PROPERTY CUSTODIAN

COMPENSATING ARRANGEMENT FOR TELEVISION TUBES

Ulrich Knick, Berlin-Zehlendorf-West, Germany; vested in the Alien Property Custodian

Application filed November 12, 1941

The present invention relates to arrangements for operating Braun tubes and has special reference to devices for compensating the fluctuations in anode voltage caused by the luminosity control of television tubes.

In television tubes the anode voltage, which mostly amounts to several thousands of volts, is usually taken from a transformer and, then, rectified and smoothed out by filtering means. It is well known, that such power supply systems will not give a constant voltage at the varying loads caused by the changes occurring in the subject-matter of the picture to be transmitted.

It was tried to neutralise these disturbing voltage fluctuations by the use of considerably bigger power supply systems, that is by connecting, in parallel to the television tubes, a constant resistor, through which is flowing a current considerably larger than that flowing through the television tube. It is true that, owing to this constant and continuous current, the fluctuation percentage of the current taken from the power supply system is rendered considerably smaller, but this procedure, let alone the high expenditure, ensures also very high losses in the parallel resistor, which in many cases renders impossible the use of said procedure. Moreover, it has been proposed to have a parallel D. C. connection of the television tube and a compensating tube, the latter being controlled in phase opposition with respect to the television tube. In practice, however, extraordinary difficulties will result, because the characteristic curves showing the grid-voltage as a function of anode-current of these two tubes must be in exact coincidence. This requires an extremely expensive mode of construction of the compensating tube, since a special type of compensating tube must be made for each type of television tubes and since, owing to the disparity of technical data occurring in single piece manufacture, only very few out of a great number of compensating tubes will possess the characteristic curve required for compensation.

Further it has been proposed to connect, in parallel with the television tube, a compensating tube which has a constant grid biasing value and is controlled by the fluctuations occurring in the anode voltage. By this method a decrease in the anode voltage fluctuations may, in fact, be obtained in a very simple way, but such decrease may be effected only, since a fluctuation in anode voltage is required for anode control of the compensating tube and a residual fluctuation of voltage will always remain. Therefore this procedure may not be employed in those cases where the requirements made upon the constancy of the anode voltage are more severe.

It is an object of the invention to combine a television tube, the corresponding power supply system, and a compensating tube in such a way that the above mentioned disadvantages will not make themselves felt and, therefore, the current taken from the power supply system will, at minimum expenditure, be held upon a value independent from the anode current of the television tube.

In accordance with the invention and in order to produce a high constant voltage, practically independent of anode fluctuations, for operating television tubes, there is connected, between the output terminals of the anode current system, a grid-controlled auxiliary tube and, between the cathode of the television tube and the negative terminal of the anode voltage system, there is connected a resistor R, which, at the same time, is situated in the grid-control circuit of the auxiliary tube. That end of the resistor which, in its direction, is away from the cathode of the television tube will be directed towards the control grid of the auxiliary tube. It is of advantage to choose the resistor R such, that the arithmetical product of the slope of the auxiliary tube and of R, measured in ohms, is bigger than 1.

In Fig. 1, the current supplied by generator 1 and having the intensity I_{ges}, is led, by way of line 2, on the one hand, to the anode of television tube 3, and, on the other hand, to the anode of auxiliary tube 4, the internal resistance of which will subsequently be indicated by R_i and the slope of which by S. Into the cathode circuit of the television tube is inserted a resistor R, which is so connected with the cathode of auxiliary tube 4, that it is traversed by the anode voltage of the television tube as well as the anode voltage of the compensating tube. The modulation voltages are led in by way of terminals 5 and 6 and conducted to the Wehnelt cylinder, provided with the leak resistor 8 of the television tube. For this reason the electron stream of the television tube is modulated as a function of the actually existing picture luminosity, and the voltage drop at resistor R will, therefore, also fluctuate in the same rhythm. At this resistor R, however, is produced the grid biasing potential for controlling grid 9 of tube 4 and, therefore, auxiliary tube 4 is controlled in the same rhythm as the television tube, but with opposite polarity.

Resistor R is in parallel with the apparent internal cathode resistance of tube 4, which is equal

to the reciprocal value of the slope of this tube. Thus the voltage drop resulting at resistor R is kept practically constant, the constancy being the better, the smaller the apparent cathode resistance (the steeper the slope) with respect to resistor R. The constant potential at resistor R will produce a constant current, flowing through this resistor, this current being, at the same time, the total current which is taken from the generator.

Resistor R is bridged, as regards A. C., by a condenser 9, and thereby it is obtained that the rapidly succeeding changes in luminosity, that is the so-called A. C. component of picture modulation, is led directly to the grid cathode space of the television tube, a substantial portion of the signal voltage put in would, possibly, be consumed in resistor R, without an effect.

If an impulse of e. g. positive polarity is, by way of terminal 5, fed into the controlling grid of the television tube, anode current I_1 of the television tube will increase by the amount ΔI_1, and at cathode resistor R there will arise an additional voltage drop $R \cdot \Delta I_1$. But as the voltage drop at resistor R is decisive of the potential of controlling grid 7 of the auxiliary tube, said potential will be more negative by the amount $R \cdot \Delta I_1$ and, the slope of the auxiliary tube being S, anode voltage I is decreased by the amount $S \cdot R \cdot \Delta I_1$. By a convenient selection of R and S it will be feasible to compensate the increase in anode current I_1 by a decrease in anode current I in such a way that the total current

$$(I_{ges} = I + I_1)$$

will, practically, be constant.

By the above-described combination of current supply system 1 and auxiliary tube 4 there will be achieved an effect as if the apparent internal resistance R'_{gen} of the current supply system, feeding the television tube, had come to be

$$R'_{gen} = \frac{\Delta Ua}{\Delta I_1} = \frac{1}{\left(\frac{S \cdot R}{R_{gen}}\right) + \frac{1}{R_i} + \frac{1}{R_{gen}}}$$

wherein R_i indicates the internal resistance of the auxiliary tube and R_{gen} the inner resistance of the current supply system without auxiliary tube.

In the illustrated circuit arrangement only the changes of the anode D. C. caused by the fluctuations in the average luminosity of the picture are compensated by the auxiliary tube, while the rapid fluctuations in the anode voltage caused by the different luminosities of the single picture spots, fluctuating around the average luminosity of the picture at a relatively high frequency, are compensated by the filtering means arranged in the anode current supply system. The time constant of R and condenser C must, however, be smaller than the period of time relating to one line change of the television transmission.

In certain cases it may be convenient to further reduce the required expenditure in filtering means by not only compensating the fluctuations in average picture luminosity, but also the anode current fluctuations caused by the picture modulation. In this case the condenser, bridging resistor R, must be left out.

The arrangement in accordance with the invention is used, to particular advantage, in combination with television tubes which are controlled in a correct ratio with respect to their luminosities, that is such to which is fed a variable D. C. component dependent upon the picture subject-matter existing at the respective instant. In television tubes, controlled in such a way, the anode current fluctuations are particularly wide and abrupt. These fluctuations can, especially, make themselves felt in sets not under control and in which picture quality is not being constantly examined by the viewer or by service people. Such sets are e. g. used for testing the quality of television transmissions, wherein single scans or successions of lines are, at certain periodically recurring times or under the influence of a remote control device, selected from a television transmission and recorded photographically.

In Fig. 2 is illustrated the wiring in which luminosity control of television tube 3 is effected by means of so-called black control. The wiring, in several details, is equivalent to the above-described wiring and corresponding parts in the two figures bear the same reference numerals. The arriving video signals are led to the controlling electrode of the television tube by way of terminals 5 and 6 and coupling condenser 7. The cathode of a diode 19 is connected to this controlling electrode, the anode of said diode being linked up with tap 13 of resistor R. By means of resistor 10, linked up with tap 12 of resistor R, the diode is under a corresponding biasing potential, whereby the television tube control of correct luminosity is secured in a manner known per se. In certain cases it may be of advantage that suitable devices be provided in order to adjust the point of operation of auxiliary tube 4, that is in order to obtain an operation within the range of steepest slope. To this effect the end of resistor R, not directed towards the television tube, is led to the slidable tap of resistor 15, which is so connected to the source of auxiliary voltage 16, that it is traversed by a current. The intensity of this current may, if necessary, be adjusted by changing the control resistor 17, and thereby or by sliding tap 14, the grid biasing potential and, therefore, the point of operation of the auxiliary tube is usually adjusted to the most advantageous voltage.

The invention is of particular advantage in combination with transformer relaxation oscillators, in which the high voltage impulses generated during the feed-back period are rectified and serve for generating high voltage for television tubes, since these devices for obtaining anode voltage have a very high apparent internal resistance, particularly if the constant potential is generated in a multiple stage system.

ULRICH KNICK.

PUBLISHED MAY 25, 1943. BY A. P. C.

U. KNICK

COMPENSATING ARRANGEMENT FOR TELEVISION TUBES

Filed Nov. 12, 1941

Serial No. 418,762

FIG. 1

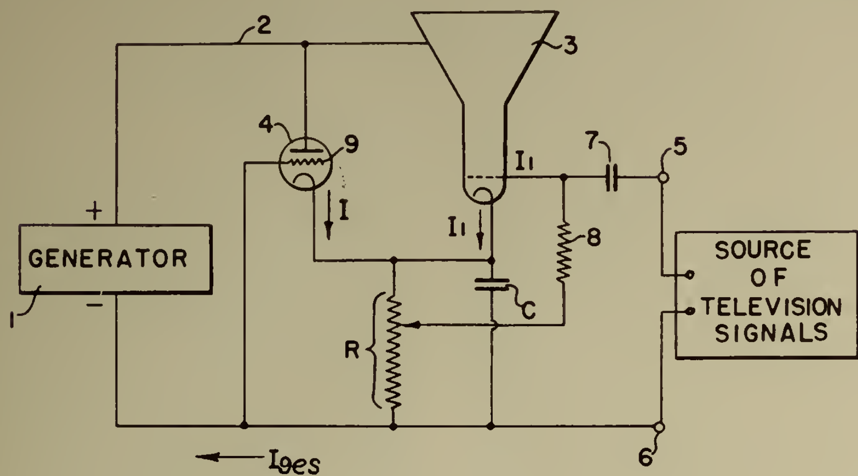
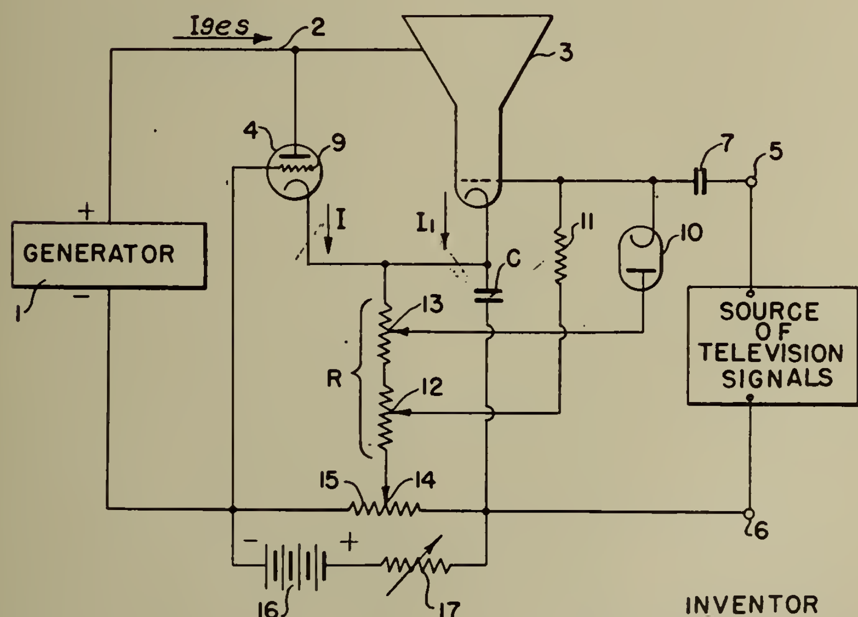


FIG. 2



INVENTOR
ULRICH KNICK

BY [signature]

ATTORNEY

Published May 25, 1943

Serial No. 419,235

ALIEN PROPERTY CUSTODIAN

APPARATUS FOR THE ABSORPTION OF GASES IN LIQUIDS

Rudolf Pflock, Nunchritz, near Grossenhain, Germany; vested in the Alien Property Custodian

Application filed November 15, 1941

My invention relates to an apparatus for absorbing gases in liquids, and in particular it also relates to the absorption of gases in liquids, wherein heat is developed by the absorption.

Heretofore, the absorption of gases in liquids was effected in towers or pipes charged with filling material, in absorption systems with cellarius vessels and similar devices. Such apparatus generally have considerable deficiencies. Above all, the distribution of gas and liquid is difficult in apparatus of a larger diameter, since the liquids are known to have a tendency of trickling down along the walls of the absorption towers. Also the cooling of such apparatus is difficult and only to be effected by a large amount of cooling water. Consequently, relatively large systems of apparatus were required heretofore. The efficiency of such systems was small when compared with their dimension. This happened especially, when gases had to be dealt with, which were diluted with large quantities of foreign gases, for instance in the case of the absorption of hydrochloric acid gas diluted with plenty of hydrogen or other gases.

The packing of such apparatus was relatively difficult, the number of the different places of packing mostly being quite large. This had an especially unfavourable effect when dealing with gases which corrode the packing material. In high towers of absorption charged with filling material, there were also great resistances disturbing the passage of the gas through the apparatus.

All these difficulties are overcome by my invention. The apparatus I have found, essentially consists of two parts which may easily be packed. It allows a thorough contact between the gas and the absorption liquid. The gas passes easily through the apparatus I have designed, and there are no such resistances to be met with as in towers charged with filling material. Absorption heat liable to occur, may easily be eliminated by cooling. The apparatus is quite small compared to its efficiency. The room needed for it is very small and the expenses for fitting it up are very low. On account of its simplicity it can be made from the most varying material, especially also from material which is cheap and may be easily supplied, for instance it may be made from glass.

An apparatus according to the present invention is illustrated by the accompanying drawing. This drawing is only meant to illustrate the scope of my invention. Details may be changed of course in different ways without departing from my invention. In Figure 1, the drawing shows a longitudinal section, Figure 2 a cross section of the absorption apparatus. The apparatus consists of an undulated pipe 2, which is put in an outer jacket pipe 1 by means of a packing or grinding. The pipe 2 is closed at the bottom; it has a distributor 8 in its upper part. This may have the shape of a hopper forming a ring around pipe 2. By a feeding pipe 6, the absorption liquid is supplied and uniformly distributed by the hopper so as to trickle down the surface of pipe 2. It collects at the bottom of pipe 1 which has an opening at its lowest point. This opening is closed by a suitable water seal or, as indicated in the drawing, by a socalled swan neck 7. Down at the jacket pipe 1 there is a side pipe 4 by which the gases to be absorbed are introduced. At the upper end of the jacket pipe 1 there is a pipe 3 through which the gases leave. For eliminating the absorption heat, a pipe 9 leading down to the bottom of the inner pipe 2 is used for supplying a cooling liquid, e. g. water, or only a cooling gas, e. g. air. The cooling liquid or gas ascends inside the pipe 2 and leaves by the socket 10.

It is fit to the purpose to put the notches (constrictions and enlargements) of the inner pipe 2 and of the outer pipe 1 against each other so as to enforce an alternate acceleration and slowing up of the gas flow. This causes a guided whirling movement of the gases, by which every single particle of the gas is always brought again in contact with the surface of the liquid. This increases the efficiency of the apparatus essentially. The wave-like outer pipe 1 may be surrounded entirely or partly by a cooling device for removing a part of the reaction-heat at the outer surface of the apparatus. The absorption of a gas by a liquid by means of the apparatus I have invented, shall be illustrated by the absorption of hydrochloric acid gas in water, though any other gas and any other liquid may be used too; for instance carbonic acid, sulphurous acid, ammonia gas, gases containing chlorine or bromine and many other gas-like products may be absorbed or caused to react in liquids. As liquids, water or aqueous solutions of acids, bases or salts, also organic liquids like alcohols, ketones, esters or hydrocarbons etc. may be used.

The absorption of hydrogen chloride from gases containing the same by means of water in my apparatus takes place in the following way:

The gas containing hydrogen chloride is introduced into the apparatus through pipe 4. Here it ascends and leaves the apparatus through pipe 5. At the same time, water is introduced into the apparatus through pipe 6; it distributes on the plate or ring 8 and trickles down along the

outer surface of pipe 2; (it may also partly trickle along the inner surface of pipe 1). Thus, an intimate contact is effected between the gas and the liquid. The water gets more and more saturated with hydrogen chloride and finally collects at the bottom of pipe 1, where it may flow off through the swan neck 7, which also shuts off the apparatus. Since much heat is developed by the absorption of the hydrogen chloride in the water, water is led through the pipe 9; this water distributes at the bottom of pipe 2 and rises until it leaves by the pipe 10. By means of a cock not shown in the drawing, the amount of water introduced through 6 is regulated so as to allow the best possible cooling and consequently a sufficient absorption of the gas. The pipe 4 may be fixed quite near the bottom of the apparatus. Then however, it is difficult to make the aqueous hydrochloric acid formed leave the apparatus sufficiently cold. Therefore it is suitable as I have found, to place the socket 14 somewhat higher up. Thus, the hydrochloric acid formed is further cooled before leaving the apparatus, without getting in contact with fresh gas.

The supply of gas is regulated so, that practically all hydrogen chloride is absorbed. However, the flow of gas may also be kept up as strong as to allow only part of the hydrogen chloride to be absorbed. For complete absorption, the gas leaving through 5 is then led to a second apparatus of the same built, adding more such apparatus if wanted. But even then, considering the small diameter and the efficiency of my apparatus, the room needed is very small when compared with the generally known apparatus of absorption, likewise the prime cost is very low. The construction of each single apparatus being very plain, even a larger set composed of several single elements requires only little attendance and supervision.

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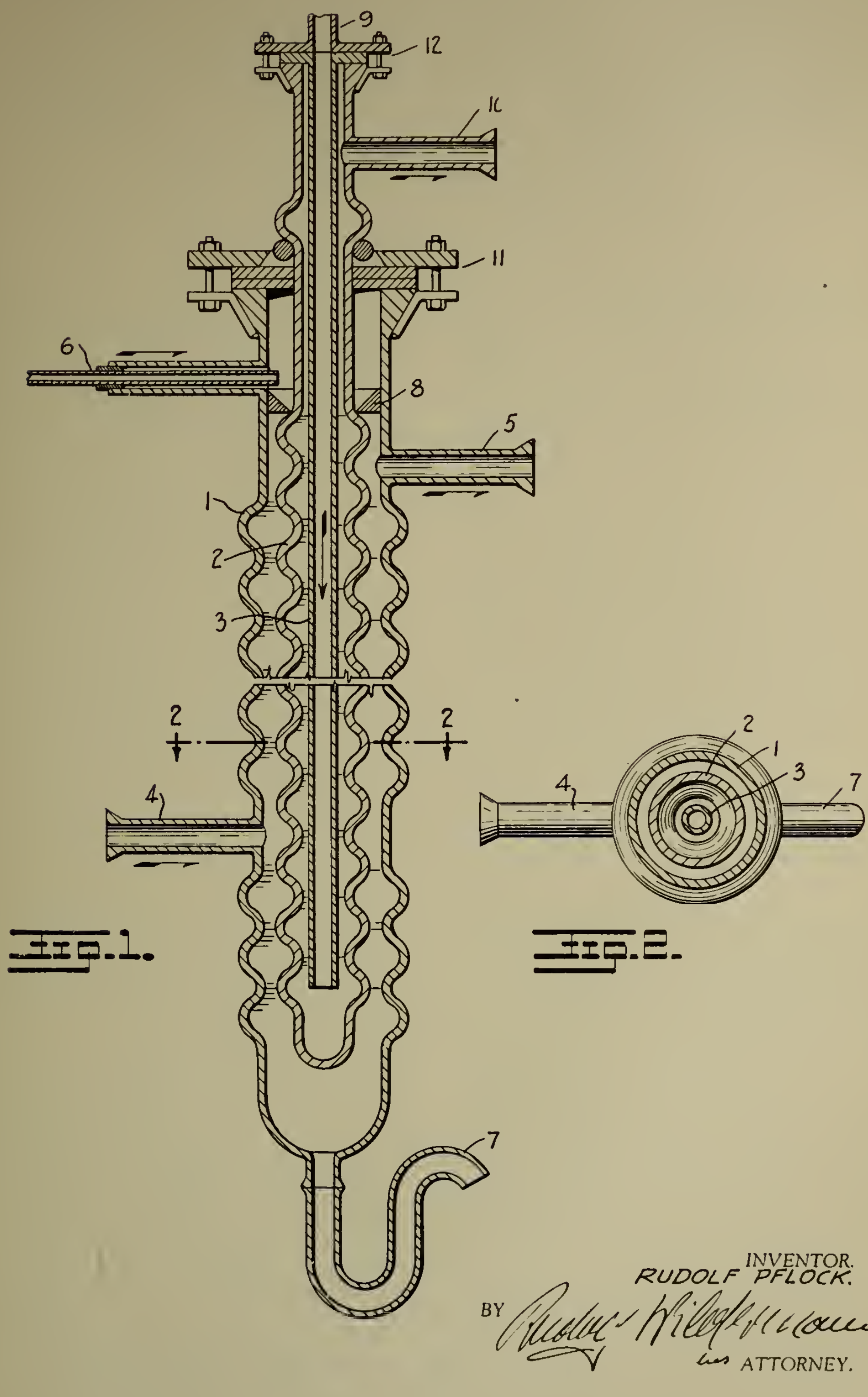

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ALIEN PROPERTY CUSTODIAN

FLOTATION-APPARATUS OF THE MECHANICALLY AGITATED TYPE

Gino Sborlino, Milan, Italy; vested in the Alien Property Custodian

Application filed November 17, 1941

This invention relates only to flotation-apparatus of the mechanically agitated type where air is sucked in from above without additional aeration under pressure from below, and the object of this invention is a combination-impeller built in such a way that the emulsification in the ore-pulp of the sucked-in air on the one hand and the transporting of the pulp on the other hand are effectuated separately from each other by the two parts of the combination-impeller with a maximum of efficiency and of economy.

Combination-impellers based on similar principles are already known in flotation-apparatus of the sub-aeration type and they consist of a horizontal disc of solid cross-section attached to the impeller shaft which bears on its underside the blades for the distribution of the air blown in, whilst its upper-side is provided with the blades for the transporting of the pulp.

This known type of combination-impeller is characterized by the important feature, that in it upper- and underside are completely separated from each other by the mentioned disc of solid cross-section and the action of this combination-impeller is thus limited to the rough distribution of the air blown-in thus impeding the surging-up of this air in a voluminous mass through the pulp to its surface, causing thus ebullition of the pulp-surface with consequential trouble in the froth-formation. Obviously this lower part of this known combination-impeller cannot beat the blown-in air into the pulp, because this part of the combination-impeller is not accessible to the pulp-current set up by the upper part of said impeller.

The present invention differs from this known combination-impeller both in design and action as set out in the following lines.

In contrast with the known combination-impeller the present invention relates to a combination-impeller where the blades effectuating the distribution and the emulsifying of the sucked-in air are placed above those serving for the transporting of the pulp, and where those upper blades are separated from the lower blades not by a disc of solid cross-section but by one of annular cross-section.

Consequently, in the combination-impeller being object of the present invention, the upper part of the impeller is fully accessible to the pulp current set up by the lower part and the upper part is thus enabled to perform its function which is the emulsifying in the pulp of the sucked-in air.

The following description accompanied by the drawing Fig. 1 to Fig. 4 serves to illustrate both design and function of the said combination-impeller.

Fig. 1 is a diagrammatic vertical section through a part of a flotation apparatus which shows the position of the combination-impeller and its action.

Fig. 2 is a longitudinal section of the combination-impeller.

Fig. 3 is a cross-section through it along III—III of Fig. 2.

Fig. 4 is the top-view of the combination-impeller according to Fig. 2.

Fig. 1 contains in diagrammatic form those constructional elements which are common features of all types of mechanically agitated flotation-apparatus where air is sucked-in from above i. e. in the flotation cell 1 a stationary bottom part 2 and another also stationary part 3 in the shape of a hollow cylinder which bears on its lower edge a bell-shaped or flat-shaped outward flaring rim 4. In the space between those two elements 2 and 3 the combination-impeller is placed (Figs. 2, 3 and 4). This combination-impeller consists of a hub 5 and two discs 6 and 7 of which the lower disc 6 is of a solid cross-section, whilst the upper disc 7 is of annular cross-section.

Between the annular disc 7 and the solid disc 6 a series of blades 8 are placed which are shaped and arranged like the blades of a centrifugal pump. The annular disc 7 bears on its upper side a series of radial blades 9 of such a height that their upper edges nearly touch the flaring rim 4.

This combination-impeller acts as follows:

In all types of mechanically agitated flotation-apparatus where air is sucked-in from above, there passes a pulp-stream downwards through the hollow cylinder 3 of Fig. 1 which along its downward passage TA Fig. 1 dissolves and entrains a considerable quantity of air. When hitting upon the bottom disc 6 of the combination-impeller, this pulp stream gets checked and builds-up a moment before it gets drawn into the bottom part of the combination-impeller, and during this building-up period the air contained in the pulp rises to the top of the built-up pulp and together with the latter gets quickly drawn in by the upper part of the combination-impeller where the radial blades effectuate the emulsifying of this air in the pulp which after passing this upper part joins immediately the upward current of the pulp created by the lower part of the combination-impeller. This combination-

impeller has the following advantages over the simple impellers used hitherto:

1. The lower part of this combination-impeller can be designed exactly like the impeller of a centrifugal pump because its task is only the transportation of the pulp and not the emulsifying in the pulp of the sucked-in air; in this way the pumping efficiency of the combination-impeller is considerably increased and thus the circulation of the pulp and with it the flotation process is considerably accelerated.

2. The upper part of this combination-impeller can be designed to best suit its task which is only the emulsifying of the sucked-in air in the pulp without having to take regard to the transportation of the pulp which is effectuated by the lower part of the combination-impeller.

It has been found advantageous to use straight blades in the upper part of the combination-impeller and to arrange them radially on the annular disc; shape and arrangement of those blades can be, however, also different from those given above as an example.

GINO SBORLINO.

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Fig. 1

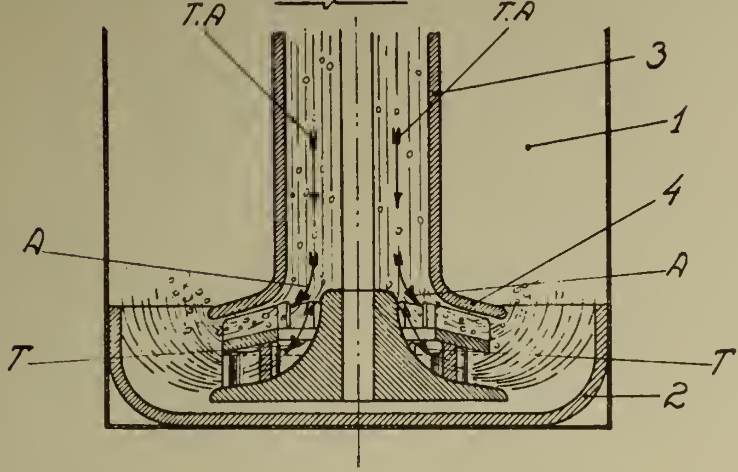


Fig. 2

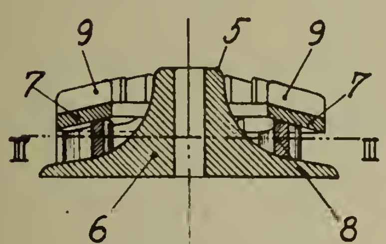


Fig. 3

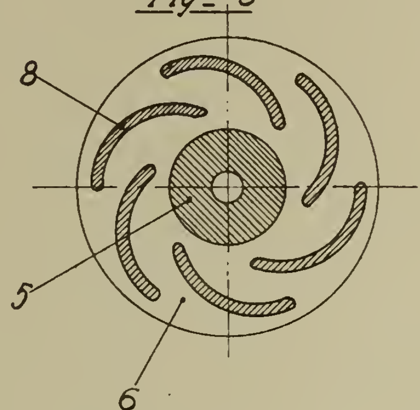
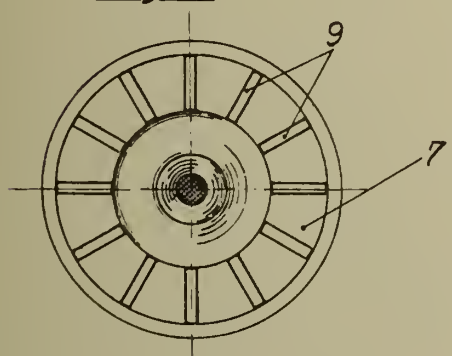


Fig. 4



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ALIEN PROPERTY CUSTODIAN

ELECTRON DISCHARGE DEVICES

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Application filed December 2, 1941

This invention relates to an electron discharge device utilizing an electron beam and suitable for use at very high frequencies, particularly to such a device in which the electrons in the beam are subjected to so-called velocity modulation and from which energy is abstracted by induction.

This invention relates to a device comprising a discharge tube in which the electrons are concentrated in a beam and traverse a control space which is bounded by two electrodes which will be referred to hereinafter as circumscribing electrodes. In the device to which the invention relates a speed or velocity control of the electrons can be brought about in the said space by means of an electrode, whereas the speed variations are converted outside the said space into variations in density.

According to the invention, the control space circumscribed by the circumscribing electrodes encloses two speed or velocity control electrodes to which are supplied control voltages of identical frequency but having a phase displacement of 180°.

The initial speed of the electrons and the length of the speed-control electrodes are preferably so chosen that the transit time of the electrons between two neighboring slits is a quarter of or half the oscillation period of the control voltages.

The device according to the invention, in which the control space bounded by the circumscribing electrodes encloses two control electrodes, has the advantage that at a given length of the speed-control electrodes the same effect is obtained as is obtained by means of a device comprising one speed-control electrode in the control space but in which the control voltage is doubled.

In addition, the device according to the invention is very advantageous if a Lecher-wire system comprising two parallel conductors is connected to the control electrodes in a symmetrical manner.

In order that the invention may be clearly understood and readily carried into effect it will now be described more fully with reference to the accompanying drawing, in which one form of construction of a device embodying it is illustrated.

The discharge tube shown in the figure comprises an exhausted glass bulb 10 containing a stem 11 at one of its ends and a stem 12 at the other end. The bulb accommodates means for generating an electron beam having a substantially constant intensity and electron speed. For this purpose use may be made of various means; the means illustrated in the drawing are to be regarded as an example only. In the present case the device for generating an electron beam comprises a heating filament 13, which is surrounded by a cathode 14, a control electrode 15 and an accelerating anode 16.

During the operation of the device the filament 13 is heated by current received from a battery 17 and the accelerating anode 16 is supplied with a suitable voltage which is positive relatively to the cathode and is derived from a source of voltage 18. The control electrode 15 is supplied with a preferably variable bias which is positive relatively to the cathode and may be furnished by a source of voltage 19.

At the other end of the tube is arranged an anode 20 whose function is to collect the electrons emitted by the cathode and which will be referred to as the "collecting electrode". On the cathode side of the collecting electrode 20 is arranged a cylindrical electrode 21 which serves respectively for collecting or repelling the secondary electrons emitted by the collecting electrode 20 and which is therefore given a potential, which is positive or negative relatively to the collecting electrode and is derived from the source of voltage 22.

Preferably, a number of coils 40 are arranged for the obtainment of a sharp concentration of the electron beam.

The control space in which the speed of the cathode ray beam can be controlled is bounded by two tubular electrodes 23 and 24 which circumscribe the path of the electron beam and are referred to hereinafter as circumscribing electrodes. In the case illustrated these circumscribing electrodes are grounded and are given a high potential which is positive relatively to the cathode and which is derived from a source of voltage 25.

According to the invention, the control space bounded by the circumscribing electrodes 23 and 24 encloses, either within or without the bulb 10, two speed-control electrodes 26 and 27 which are supplied with control voltages of the same frequency having a relative phase displacement of 180°. Due to the potential variation in the control space relatively to the limiting potentials of this space speed control or in fact velocity modulation of the electron beam is obtained.

The electrons which at a given moment are enclosed in the control space between two electrodes, for example the electrodes 23 and 26, are accelerated or delayed according as the voltage of the electrode into which the electron enters, for example the electrode 26, is positive or negative at that moment relatively to that of the electrode 23 which the electron leaves, while the same occurs with the electrons which are enclosed between the electrodes 26 and 27 or 27 and 24. In

the device according to the invention in which the circumscribing electrodes are separated by two speed-control electrodes which are supplied with voltages having a phase displacement of 180°, the speed or velocity modulation obtained is a maximum if the initial speed of the electrons and the axial length of the electrodes 26 and 27 are such that the transit time of the electrons between neighboring slits or gaps in the control space is π, wherein 2π is equal to the oscillation period of the control oscillation. In this case, the electrons which enter into the control space at the electrode 23 will leave the control space at the electrode 24 about an entire cycle of the supplied control voltage later, whereas in the control space the passage from the electrode 26 to the electrode 27 ensues approximately within half a period. An electron which enters into the electrode 26 at a moment when this electrode has the maximum positive voltage, for example a voltage E, relatively to the circumscribing electrodes 23 and 24 will therefore leave the electrode 27 at a moment when this electrode has the maximum negative voltage relatively to the circumscribing electrodes so that both on entering and on leaving the control space the electron is accelerated under the influence of the control voltage E. In addition, the passage from the electrode 26 to the electrode 27 ensues for the relevant electron at the moment when there exists a voltage 2E between the electrodes 26 and 27, the electrode 27 being positive relatively to the electrode 26, so that on passing from the electrode 26 to the electrode 27 the electron is accelerated under the influence of the voltage 2E.

Similarly, an electron which enters the electrode 26 at the moment when the electrode 26 has a negative velocity E relatively to the electrode 23 will leave the electrode 27 at a moment when this electrode has a positive velocity E relatively to the electrode 24 with the result that this electron is retarded both on entering and on leaving the control space. In addition, the passage from the electrode 26 to the electrode 27 ensues at a moment when the electrode 26 has a positive voltage 2E relatively to the electrode 27 and on passing from the electrode 26 to the electrode 27 the electron is retarded under the influence of the voltage 2E.

The electrons which enter the control space at the above-mentioned moments are consequently accelerated or retarded respectively in succession on passing from one electrode to the next following under the influence of a voltage E, 2E and E, which has the same effect as though under the influence of a voltage 4E an acceleration or retardation respectively were brought about once.

Owing to this, an electron beam which has passed through the electrode system 24, 25 will be constituted by electrons having a higher and electrons having a lower speed than the initial speed of the electrons in the beam.

The electrodes 26 and 27 are supplied with control voltages having a relative phase displacement of 180° by inserting an oscillatory circuit between the electrodes 26 and 27 and feeding a control voltage to this circuit. Preferably, the middle point of each of the electrodes is connected to one of the conductors of a Lecher-line system 28 comprising two parallel conductors and whose middle point may be grounded through a high frequency choke coil while its length is so regulated by means of a bridge 29 that the circuit formed by the Lecher conductors and the electrodes 26 and 27 is tuned to the frequency of the control oscillation.

The speed variations are converted into variations in intensity outside the control space in a so-called overtaking or drift space, said space being formed by the space enclosed by the electrode 24. In this field free space the accelerated electrons after some time will have overtaken the retarded electrons so that in the beam are produced density variations or in fact intensity variations, which latter are dependent on the speed variations present and thus on the amplitude of the control voltage which is supplied in counter phase to the electrodes 26 and 27.

For the purpose of deriving energy from the beam that is varied in intensity, the electron beam is passed through a space circumscribed by two electrodes 24 and 34 which, internally or externally of the tube 10, preferably enclose two electrodes 36 and 37.

The electrodes 36 and 37 are interconnected by an oscillatory circuit 38 which is so proportioned that the circuit formed by the circuit 38 and the electrodes 36 and 37 is tuned to the frequency of the control oscillation or a harmonic thereof. In the given form of construction the oscillatory circuit is formed by a Lecher-line system comprising two conductors whose length can be adjusted by means of a bridge 39 and each of which is connected to the middle point of one of the electrodes 36 and 37 respectively. The electrical middle point of the circuit which is formed by the Lecher-line system and the electrodes 36 and 37 is preferably earthed via a high-frequency choke coil and thus has the same potential as the circumscribing electrodes. On passing through the space bounded by the electrodes 24 and 34, the groups of electrons of variable density induce an alternating current in the circuit which connects the electrodes 36 and 37 whose frequency corresponds to that of the control voltage supplied to the electrodes 26 and 27. Due to this oscillations are generated in the oscillator circuit 38 having the same frequency or a harmonic frequency thereof; these oscillations bring about voltages having a phase difference of 180° at the electrodes 36 and 37 and may be supplied to a load circuit. The induction-effect is a maximum if the dimension of the electrodes 36 and 37 in the direction of the beam is such that the transit time of the electrons between two neighboring slits or gaps is half a cycle.

Owing to the symmetrical construction of the electrodes 23, 26, 27 and 24 which form the control space and of the electrodes 24, 36, 37 and 34 which form the space from which oscillations can be derived, the device according to the invention is particularly suitable for the use of a Lecher-line system comprising two parallel conductors for supplying and deriving energy. Such a Lecher-wire system has the advantage over the use of concentric conductors that leading Lecher wires through the tube wall is easily done.

If desired each of the control electrodes 26 and 27 or 36 and 37 respectively may be connected to the corresponding conductors of two Lecher-line systems diametrically arranged relatively to the control electrodes and in this case the influence of the capacity which the control electrodes form relatively to the surroundings on each of the Lecher-line systems is half that of the capacity in the use of only one Lecher-line system. Such a construction in which each of the electrodes 26 and 27 or 36 and 37 respectively is provided with two diametrically arranged lead-

ing-in wires thus permits of increasing the natural frequency of the oscillatory system of which the electrodes form part.

In the form of construction described the length of the electrodes 26 and 27 was such that the transit time of the electrons along these electrodes is half an oscillation period and in this case the speed modulation obtained ensues under the influence of a voltage 4E in which E is the maximum amplitude of the control voltages supplied to the electrodes 26 and 27. The same speed control can be obtained if use is made of a discharge tube in which the electrodes 26 and 27 have half the above-mentioned length or in other words are so long that the spacing between neighboring slits is a quarter of the oscillation period of the control oscillation if the maximum amplitude of the control voltage supplied is 2E. As a matter of fact, with this choice of the length of the electrodes 36 and 37 an electron that enters the control space at the moment at which there is no potential difference between the electrodes 23 and 26 will pass through the intermediate space between the electrodes 26 and 27 after a quarter of the oscillation period of the control oscillation and at this moment the electrode 27 has either a positive or a negative voltage of 4E relatively to the electrode 26 so that the electron that entered the control space without being accelerated or retarded is accelerated or retarded respectively on passing from the electrode 26 to the electrode 27 under action of a voltage 4E. On the control space being left a quarter of the oscillation period later, again an acceleration does not occur, because at this moment there is no voltage drop between the electrodes 27 and 24.

The electrodes 36 and 37 may be given a corresponding length.

The form of construction in which the length of the electrodes 26 and 27 is such that the transit time of the electrons between neighboring slits is a quarter of the oscillation period of the control oscillation offers the advantage that the capacity which the electrodes 26 and 27 form relatively to each other and to the surroundings is materially lower than in the other form of construction described so that this form of construction permits of obtaining oscillations of higher frequency. In addition, it may be observed that the more the length of the control electrodes increases the greater is the possibility that density variations occur even in the control space with the result that the speed control ensuing at the ends of the control space becomes less effective. Furthermore, it must be borne in mind that the length of the speed control electrode may have any value between the very favorable values indicated in the forms of construction described.

The device according to the invention is not only adapted for amplifying a control oscillation which is supplied in counter phase to the speed control electrodes 26 and 27; it may also be used for generating oscillations and in this case the circuits 28 and 38 should be coupled together. In addition, the device according to the invention has been found to be highly advantageous for frequency-changing, for example mixing of ultra-high frequency oscillations, and in this case use is preferably made of a device comprising at least two electrode systems for controlling the speed of the electrons, the said systems having respectively supplied to them control voltages of different frequencies.

For generating, amplifying or changing the frequency of oscillations of very high frequency the electrodes 26 and 27 or 36 and 37 respectively are united for example to form a hollow body which is tuned to the frequency of oscillations to be generated, amplified or changed in frequency.

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K. POSTHUMUS ET AL
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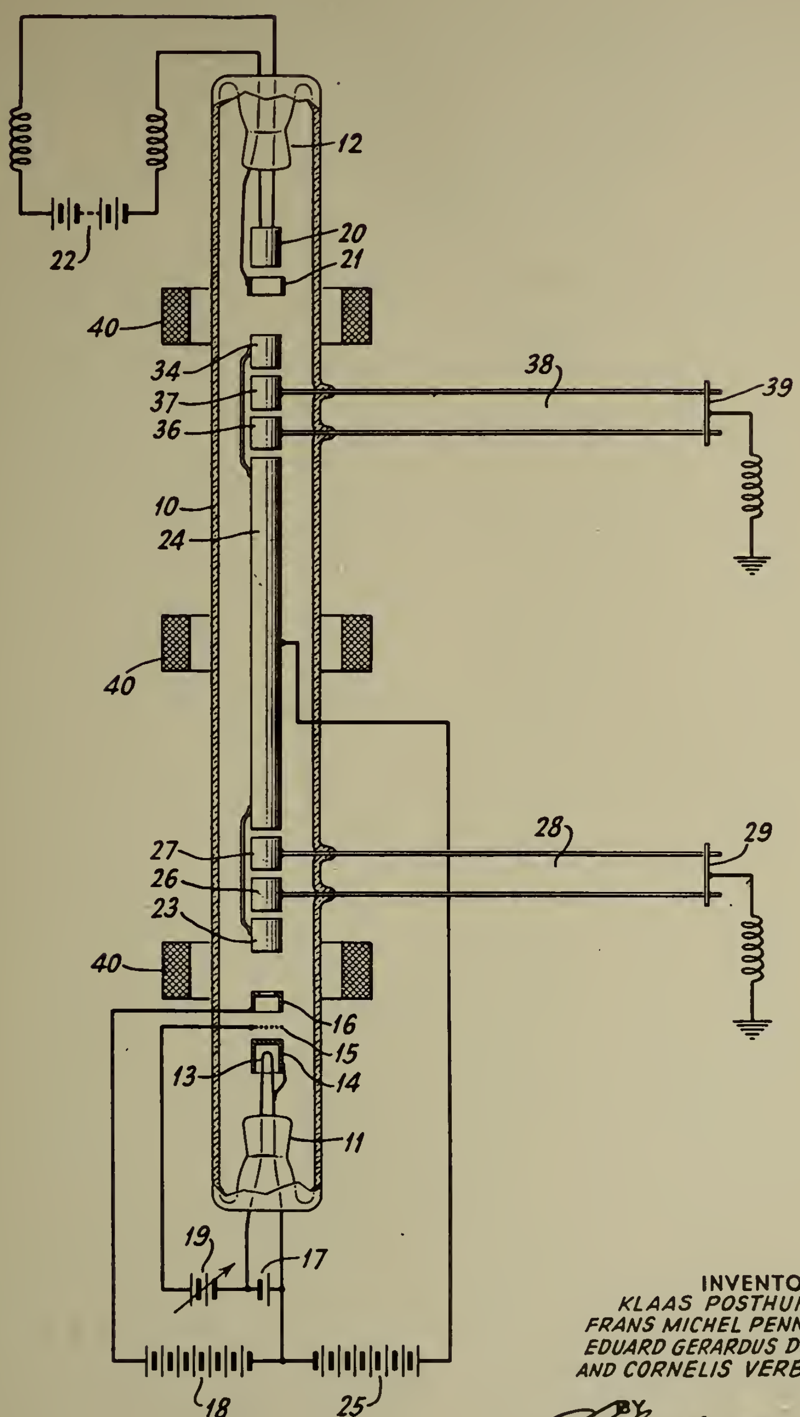

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ALIEN PROPERTY CUSTODIAN

CATHODE RAY TUBE SYSTEM

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Application filed December 2, 1941

My invention relates to electron discharge tubes and systems of the cathode ray type and particularly to an improved electrode structure for use in such tubes and systems.

In cathode ray tubes of the types utilized for recreation of television images and for oscillograph purposes it is desirable to provide a structure capable of developing an electron beam of high electron density while at the same time limiting the cross sectional diameter at the target to a value as small as possible. High electron beam current may be obtained while retaining a small beam cross section at the target or fluorescent screen by focusing the electron streams from the cathode with the aid of a preconcentration system and by projecting a section of the beam thus formed on to the screen by means of an electrostatic lens system. In this case it is desirable to utilize an apertured diaphragm serving to limit the cross-sectional area of the beam of rays in order to avoid stray electrons impinging on the target or screen in the environment of the picture proper and producing additional light or halation over the target. Such a diaphragm has the disadvantage that the electrons which are intercepted produce secondary electron emission and if no particular provisions are made the secondary electrons thus liberated impinge not only on the target but also on other electrodes such as the deflecting plates and cause a variation of the potential of these plates if they are connected to a scanning circuit through a comparatively high resistance. This has the troublesome effect that the picture point on the screen varies its position with the current and the figure described by this point is deformed. The influence of the secondary emission is reduced if the apertured diaphragm is placed nearer to the cathode. Thus if it is secured to the first electrode or anode of the electrostatic projection system, then nearly all the electrons liberated by secondary emission are collected by the electrodes of the projection system, especially if the diaphragm is located in an electrostatic field free space. In this case, however, another difficulty is encountered in that the electrons which impinge on the diaphragm have the effect of reducing the potential of the associated anode which is usually connected across a comparatively high resistance to a source of potential. This results in a fluctuation of the anode potential and of the focal distance of the projection system and this causes defocusing of the image on the target screen. Consequently, with variation of the beam current, the voltage ratio between the electrodes varies, and must be adjusted subsequently, in order to keep the image sharp and in focus.

It is an object of my invention to provide a cathode ray tube and system wherein the electron beam may be maintained in a focused condition notwithstanding wide variations in beam current. It is another object to provide a cathode ray tube system utilizing an electron gun having a plurality of anodes wherein variation in the ratio of the potentials applied to the anodes is minimized, thereby minimizing variation in focus of the electron beam. A further object is to provide a tube of the type described wherein secondary electron emission is collected in such a manner as to minimize potential variation of the electrodes, and it is a still further object to control the variation of the focal distance of the electron beam in such a manner that the disadvantages referred to above are eliminated. These and other objects, features and advantages of my invention will become apparent when considered in view of the following description and the accompanying drawing, in which:

Figure 1 is a longitudinal view of a cathode ray tube system having electrode structure made and operated in accordance with my invention, and

Figure 2 is a cross sectional view of one of the electrodes shown in Figure 1 taken along the line 2—2.

I have found that it is almost exclusively those secondary electrons which emanate from the margin of a diaphragm in the end electrode which bring about troublesome phenomena, such as shift of the picture point and diffused screen light. Therefore, in accordance with my invention, I provide a structure wherein the electron beam is limited by an apertured diaphragm which is located at such a point that it does not emit harmful secondary and reflected electrons but transmits only those primary electrons which cannot generate any appreciable harmful secondary radiation from further electrodes of the structure. Further, in accordance with my invention I provide a diaphragm which collects only the stray electrons which directly adjoin the electron beam which is to be utilized to generate light on a target such as a fluorescent screen. Thus the stray electrons can no longer impinge on a further electrode at a position which might cause further secondary electron emission and therefore no serious trouble is encountered from secondary electrons emitted from this electrode. The potential of the apertured diaphragm, and

associated anode limiting the rays and consequently the focal distance of the projection system are variable to a smaller degree since a great portion of the rays which are not used is not intercepted by the diaphragm and consequently does not contribute to the voltage variation of the diaphragm.

The invention will be more clearly understood with reference to Figure 1 wherein the highly evacuated envelope E is of elongated shape provided with a neck section enclosing an electron gun made in accordance with my invention and a frusto-conical section enclosing a target electrode such as the fluorescent screen S. The preconcentration system of the electron gun is constituted by the cathode 1 which may be of the directly heated type or indirectly heated type as shown, a control electrode 2, and a suction or first anode 3. This first anode 3 is of tubular shape and includes an apertured disc 4. The cathode 1, control electrode 2, first anode 3 and second anode 5 constitute the electron gun capable of developing and focusing a beam of electrons upon the target or fluorescent screen S.

Due to the electric field between the cathode 1 and the first anode 3, the electrons are accelerated through the control electrode 2 which has a negative voltage relative to the cathode causing the electron paths to converge toward the electron gun axis to form an electron beam 6. In the tube represented in Figure 1 the voltages applied to the electrodes have such values that the paths of the electrons emitted from any point of the emitting surface of the cathode intersect or cross over each other in the vicinity of the first anode apertured disc 4. Consequently, the intersection of the electron paths to form the beam 6 is not at a mathematical point but over a small surface at which the beam has a minimum cross section. After the electrons of the beam 6 pass the cross-over point they follow divergent paths and are subsequently directed by the electrostatic fields between the first and second anodes on to the fluorescent screen S. While I have shown a structure in which the electrons converge from the cathode at a cross-over point, the electrons may alternatively diverge from the cathode. The first anode 3 and second anode 5 are maintained at positive potentials with respect to the cathode 1, preferably by a single potential source 8. Since the first anode is operated at a lower potential with respect to the cathode than the potential of the second anode, I provide a bleeder or potentiometer 9 of high resistance shunted across the source 8 to derive the potential applied to the first anode 4 such as by the variable lead 10 from the source 8.

In accordance with the invention, and in order to prevent excessive variation of the ratio of potentials existing on the first and second anodes, I provide a multi-apertured diaphragm 11, which is so shaped as to intercept only part of the rays which are not used. As can be seen more clearly from Figure 2, the diaphragm 11 has a central aperture 12 which is aligned with the axis of the electron gun and a plurality of outer apertures 13 off the electron gun axis. The central portion 14 of the diaphragm is preferably of annular shape and intercepts the rays in a region which directly adjoins the beam, transmitting through the apertures 13 the rays running in a marginal region 15 which is still further away from the axis. The latter rays consequently reach the electrode 5 but do not produce any harmful secondary emission since they impinge on the electrode at points from which the secondary electrons cannot penetrate through the aperture 16 in the diaphragm 7. The secondary electrons which are produced at the central portion 14 of the diaphragm 11 do not bring about disadvantageous phenomena since the diaphragm is positioned in an almost field-free space so that the secondary electrons are not accelerated in the direction of the aperture 15.

While wide fluctuations of the potential of the first anode 3 with varying beam intensities are eliminated, due to the particular shape of the diaphragm 11, some residual variation in this potential due to the collection of electrons by the central annular portion is desirable. The intensity of the beam is controlled by setting up a voltage between points 17 and 18 in the connection between the control electrode 2 and the cathode 1, which voltage renders the electrode 2 negative with respect to the cathode. The greater this potential difference, the weaker is the beam current but also the more are compressed the rays emanating from the cathode. Consequently, the cross-over point of the beam electrons adjacent the apertured disc 4 will be located nearer to the cathode at comparatively high modulation voltages. However, the residual variation of the first anode potential compensates for any defocusing of the electron beam and the focal distance of the lens system is rendered substantially constant with variation of electron beam intensity. It is very desirable that the area of the central portion 14 and of the apertures 12 and 13 of the diaphragm 11 should be chosen to collect a portion of the electron flow thereby obtaining some slight variation of first anode potential with varying beam current. In conventional circuits this variation of the first anode potential and of focal distance is far too great with a diaphragm which intercepts all the marginal rays so that the displacement of the cross-over point of the electrons is overcompensated in this case. The ratio of the surface of the annular portion 14 to aperture 13 area may be determined by trial but in any case apertures to allow marginal electrons to pass to the second anode must be provided to obtain the benefits of my invention. The diaphragm 11 may also be constituted by a plurality of concentric rings or it may have a helical portion surrounding the annular central portion 14. The essential thing is that a central portion of the beam is transmitted and a portion of annular section about it is intercepted and outside the annular portion a quantity of rays is transmitted.

In the application of cathode ray tubes to oscillography it is often possible for the electrode voltage to be adjusted during use and thus to keep the beam in focus. In many cases, however, especially in recording of transient phenomena the short duration of the surges to be measured necessitates an automatic control which makes the use of my invention particularly desirable.

JOHANNES DE GIER.

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J. DE GIER
CATHODE RAY TUBE SYSTEM
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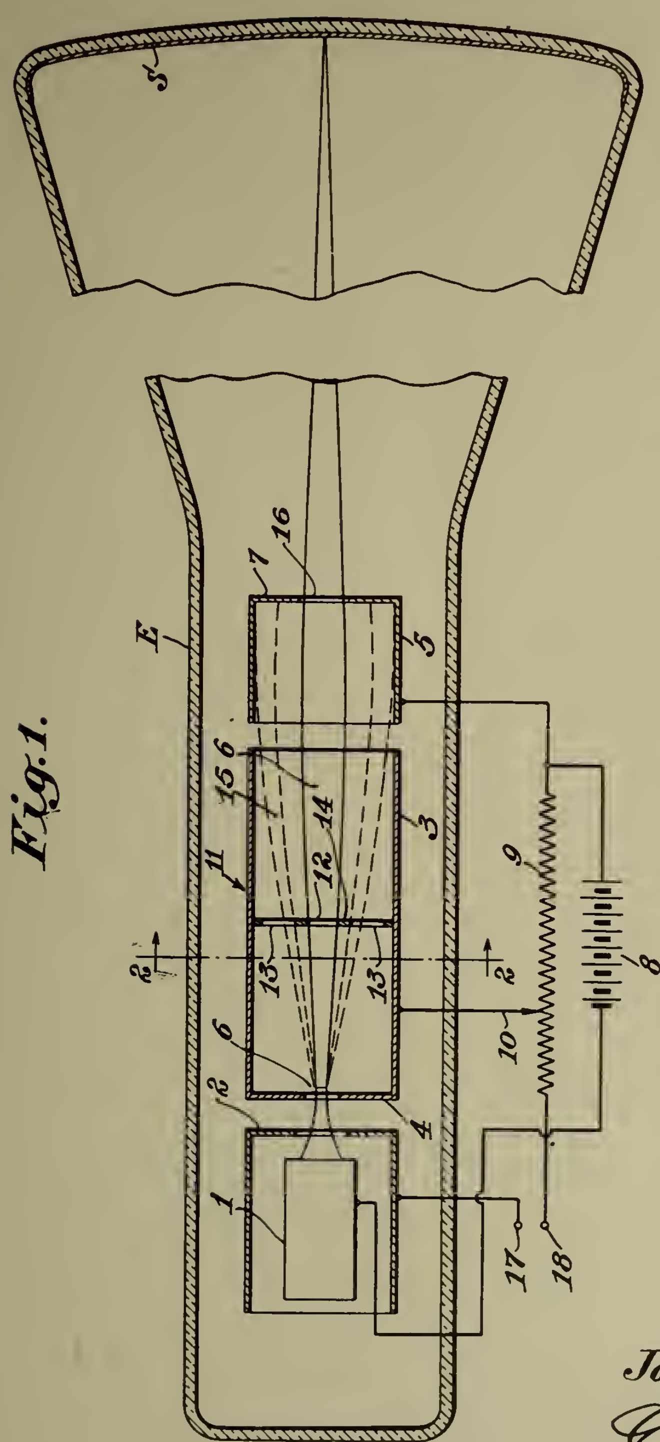

Fig. 1.

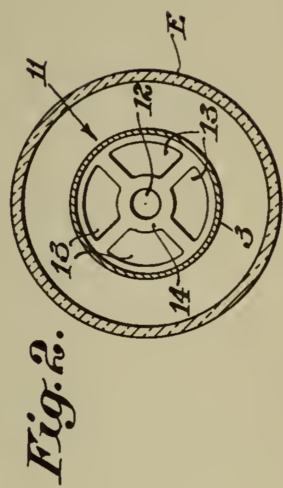

Fig. 2.

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ALIEN PROPERTY CUSTODIAN

HEAT PRODUCING AND CONSUMING SYSTEMS

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Application filed December 6, 1941

The invention relates to a heat producing and consuming system comprising a heat producer, a plurality of heat consumers having a non-uniform heat consumption and means for controlling the heat production per unit of time.

It is an object of the invention to improve particularly the means for the control of the heat production which ought to be dependent on the heat consumption.

It is a further object of the invention to enable a heat producing and consuming system to be controlled efficiently, the heat production always being exactly in accordance with the heat consumption, no loss nor shortage of heat occurring when the heat consumption changes.

The invention aims at placing at the disposition of every single heat consumer a certain fraction of the total heat producing capacity, said fraction being exactly determined in its extent in accordance with the highest demand for heat by the consumer in question.

Another object of the invention is to control the system by regulating the capacity of the fire, preferably beforehand, so as to have the change of said capacity already started when a change in heat consumption is expected in future, and the change in heat production will be completed when the change in heat consumption really occurs.

Usual control systems of the kind referred to as a rule operated in dependency on one main factor, such as a steam or water temperature, a steam pressure, a room temperature, an outer temperature, the rate of cooling down of a building etc. There were provided sometimes more than one observation or controlling member it is true (e. g. in the case of a heating system for a building, an outer thermostat recording the cooling action of the outer air and in addition thereto a room thermostat recording a temperature), but also in this event one is acting in dependence on the other, e. g. in such a manner that the room thermostat is arranged to exert influence on the artificial heating and thus on the times of working of the outer thermostat, so that actually the outer thermostat only effects the controlling action.

Furthermore it was known to have the capacity of a heating device increased or decreased by means of adjusting or setting by hand when an increase or decrease in heat consumption was expected. This is found e. g. in the case of steam heated cooking vessels when a cooking vessel is put into or out of action. Also in plants where the output of energy usually changes at a certain time (such as in electrical works) it is usual to have the capacity of the fire already changed at an earlier moment. In this case there is a certain range of control between a lowest and a highest value of the fire capacity which is used arbitrarily by increasing or decreasing the existing capacity on behalf of all consumers together. Control becomes however very inexact in this way.

Furthermore it is necessary to also take into consideration other consumers belonging to the same heat production system, such as a water heating system, a kitchen etc., which may also show changes in heat consumption.

The invention aims at a control of the fire capacity which is automatically exact as to quantity, particularly in the case of more than one consumer. This is obtained in that control is effected in dependence on controlling impulses from or on behalf of each of the consumers, each of such impulses operating within a control range corresponding with a predetermined fraction of the possible change in fire capacity between a minimum and a maximum value, the said fraction corresponding with the consumption available for and admitted to the consumer in question, whereas all impulse influences are superimposed, i. e. are added to one another.

As a rule controlling systems are only sensitive to the consequences of a change in, or the appearance or disappearance of external, i. e. outer factors indicating a future change in heat consumption (e. g. a change in the outer temperature, reaching a certain time when cooking shall begin etc.). This means that control only takes place when the balance between heat production and consumption as existing or as aimed at as yet, does not already exist (repressive control). The thermostat at the steam or water temperature records the decrease in temperature in a steam cooking or hot water plant, after heating of a further cooking vessel or the delivery of hot bathing water has already started, which of course is too late. In the same way a room thermostat records too late that the outer temperature has fallen or that the velocity of the wind has increased. As long as the heating system due to the exerted controlling impulse, has not reached the higher temperature level which is necessary for the increased delivery of heat, the temperature of the heated room is too low.

Therefore according to the invention control is effected direct, that means, factors which have influence on the fire capacity in first instance are controlled, such as the rate of flow of the supply

of fuel or combustion air, the surface of the grid and the like. Furthermore control is exerted preventively so as to have the change in the heat production in accordance with heat consumption, completed at the time the latter change occurs. If e. g. in the case of central heating the outer temperature decreases, the invention aims at such a control, that if the decreasing outer temperature will exert its influence in half an hour, the capacity of the fire has to be decreased during this time to the desired extent, and that exactly.

Apart from the control according to the invention other control systems (momentary controls) may be maintained. The room thermostat may e. g. continue to vary the (newly set) surface temperature of the heating radiators, or in the case of intermittently operating systems (oil burners) the said thermostat may continue to control switching in and switching off the heat production. Such control is then "secondary".

The annexed drawings illustrate a single embodiment of the invention and that very diagrammatically.

This embodiment concerns the control of a heating system comprising a so-called underfeed-furnace consuming solid fuel.

The boiler 1 is only shown in part and that in cross section. The figure shows the grid 2 and the centrally arranged fuel supply aperture 3 through which from below coal is forced through the grid 2 into the burning fuel layer. The coal supply is effected by a conveying screw 4 fed from a hopper 5. This hopper may actually constitute the bunker space or in turn may be connected to a conveying system feeding the fuel from a distant coal supply.

The conveying screw 4 is operated by a shaft 6 which generally is arranged to be driven at a very low, but for all that regulable speed. The principle of a driving system of this kind is shown in the drawing.

The driving motor 10 operates a worm screw 11 engaging a worm wheel 12. A crank or eccentric 13 on the shaft of the worm wheel 12 drives, through the medium of a connecting rod 14, a swing arm 15 having at one end a pawl 16 secured thereto. This pawl is arranged to cooperate with a ratchet wheel 17 secured to the shaft 6. A second pawl 18 prevents the ratchet wheel 17 to rotate in opposite direction.

Preferably two pawls 16 will be provided, so that such pawls operate alternately so as to impart to the shaft 6 a more continuous movement. In addition the axis of the crank or eccentric 13 may be arranged co-axially with the ratchet wheel 17 and the shaft 16 to render the construction more compact. In general the driving means will moreover be arranged at some distance from the shaft 6, in other words, the ratchet wheel 17 will be connected to the shaft 6 by a chain or the like transmitting means.

The speed control of the shaft 6 is obtained by varying the throw of the pawl 16 at each operation as is usual in devices of this kind. The drawing shows for this purpose a kind of screen 19 rotatably mounted on the axis of the ratchet wheel 17 and operating to prevent the pawl 16 from entering into engagement with the ratchet teeth during a predetermined, variable stretch of its throw. In this manner the number of ratchet tooth-pitches, through which the ratchet wheel 17 is rotated at each throw of the pawl 16 and therefore at each revolution of the worm wheel 12, is determined.

The above regulating system, now serves to adjust the said screen 19, this being effected through the medium of a rod 20 operated by a servo-motor. The latter is diagrammatically represented in the drawing by an electromagnet comprising a core 21 and a coil 22. The core 21 is suspended from a spring 23. Dependent on the current intensity in the coil 22, the core 21 is more or less raised causing thereby the screen 19 to be adjusted proportionally, for regulating the coal supply to the boiler correspondingly. The current is supplied to the coil 22 from the mains 24. Each heat consumer is arranged to close the circuit through the coil and that in a certain manner over a resistance, so that each heat consumer effects a predetermined current intensity in the coil 22, such current intensities in the case of simultaneous operation of a plurality of heat consumers being superimposed, so that the variations of the fire capacity exactly and proportionally correspond with the variations occurring in the heat consumption.

As an example of heat consumers may e. g. be mentioned:

1. A heat consumer adapted to be put into operation by the operator at any moment with a predetermined fixed capacity, e. g. a cooking boiler,

2. The heating of a building under the control of an outside thermostat,

3. A heat consumer, which permits of an augmentation or reduction of the heat production capacity with a certain amount and at a predetermined moment under the control of a clockwork.

For the first consumer there is provided a simple switch 25 for instance a push button switch. The current, at the closing of the circuit, is supplied to the coil 22 through a variable resistance 26, so that a certain current intensity is set up in the coil 22. If, for instance, a cooking boiler is to be switched on, the cook presses the button 25. The core 21 is pulled up so far, that the capacity of the fire in the boiler 1 is increased to such an extent, that the heat consumption of the cooking boiler is just met.

The heating of the building (second example) is controlled by an outside thermostat 27 responsive to the cooling down of the building. The control is effected by an arm 28 connected in a second circuit and cooperating therein with a resistance 29. As the outer temperature rises, the arm 28 swings anti-clockwise, causing the resistance in said second circuit to be augmented. This causes the current intensity to be decreased resulting in a proportional lowering of the core 21 and a corresponding proportional reduction of the capacity of the fire. It will be understood that in this second circuit there is also provided a fixed but adjustable resistance 30 on behalf of the adjustment of the regulating system.

The third circuit with which current may be supplied to the coil 22 contains a clock switch 31. Assuming the contact 32 of such clock switch, which is adjustable through 360°, to be set for three o'clock, as shown in the drawing. At that time a current of predetermined intensity will be supplied to the coil 22 through said third circuit via the clock-hand and the contact 32 causing the core 21 to be raised a certain amount, the capacity of the fire increasing proportionally. 33 again indicates an adjustable but for the rest fixed resistance.

From the above it will be understood that each heat consumer switches on or off, resp. controls

its own portion of the entire fire capacity and that several capacity portions are superimposed automatically.

It will, of course, be preferable to still add to the coil **22** itself, an adjusting resistance, for regulating the range of throw of the core **21**. In addition thereto and in parallel with the coil **22** there is provided a variable resistance **35** which is operated when the rate of control of the fire capacity by the regulating system has to be altered as for instance when the quality of the fuel changes.

The various regulating circuits may further contain retarding elements. When, for instance, the outside thermostat **27** observes the necessity of an increase of fire capacity, such increase may not be necessary until after, say, half an hour, as the influence of the fall in the outer temperature will only then be noticeable. Such retardation may, for instance, be obtained by means of a clock switch.

In practice a more complicated electric system will be used than that shown in the drawing. For instance, for the outside thermostat a potentiometer circuit may be used for transmitting the indication. Moreover relays will be inserted enabling the weak control impulses to be converted into strong control impulses. The eventual adjustment of the screen **19** will have to be effected by an actual motor which in turn is controlled by a position adjusting cylinder with a time switch by which, dependent on the control impulses received, the cylinder is rotated at every time through a certain number of steps in one direction or the other. The electric solutions of this problem, however, lie without the scope of the present invention.

In addition to the primary and preventively operating regulating system as shown, secondary regulating devices may be maintained. The CO_2 content of the flue gases, for instance, may continue to control the flue damper. In addition thereto, however, the steam pressure, a room temperature, a water temperature etc. may continue to exert their influence on the capacity of the fire.

The servo-motor systems and their control may also be pneumatically, hydraulically or mechanically operated instead of electrically.

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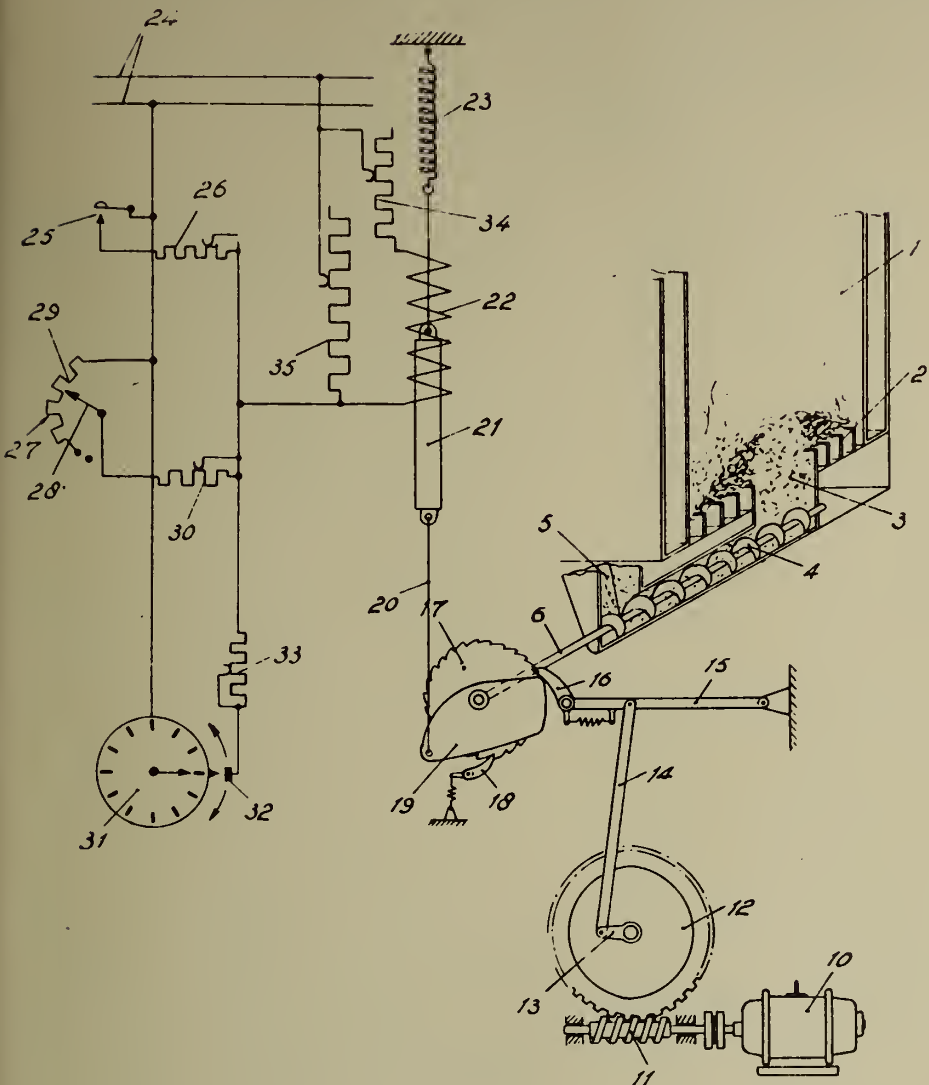

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ALIEN PROPERTY CUSTODIAN

LUMINESCENT MATERIAL

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Application filed December 9, 1941

The invention relates to a process for synthesizing luminescent materials and, in particular, is directed to producing luminescent materials of improved properties and with the further advantage that the resistance of the resultant material against loss of luminosity by impacting ions is greatly reduced.

Luminescent materials particularly those adapted to become excited under the influence of electric bombardment such as cathode ray beams in tubes used for television, oscillographs and allied uses have been known for some time by the commonly used luminescent materials known to the workers in the art. These luminescent materials had the drawback that during the operation of the tube a dark spot of larger or smaller dimensions appeared on the fluorescent screen and that this spot became darker and darker with increasing time of operation. The existence of this spot is explained by the fact that an ion stream is produced within the tube and that this ion stream remains undeflected by the magnetic deflecting means so that the ions impact always the same spot of the luminescent screen during the entire period of operation. This ion bombardment reduces the luminescence of the luminescent material.

It is known that zinc-silicate and borium-nitrate are sufficiently insensitive to impacting ions. These materials however can not be used in many cases on account of other undesirable properties. The opinion was up to now that zinc-sulfide and cadmium-sulfide are very sensitive to ion bombardment so that their luminosity is reduced within very short periods of operation.

Accordingly it is one of the purposes of our invention to provide a luminescent material of the zinc-cadmium sulfide type whose sensitivity against the influences of ion bombardment is greatly reduced.

A further object of our invention is to provide a luminescent material of the sulfide type which will emit white light of high intensity under cathode ray bombardment.

Other objects and advantages of our invention will be immediately apparent to those skilled in the art upon reading the following description of our invention.

According to the invention the luminescent material is a crystalline structure comprising the components of the sulfide type in a single crystal lattice structure in such a composition that the components are in stoicheiometric equilibrium in the crystal. The luminescent material contains f. i. zinc-sulfide ZnS and cadium sulfide CdS in stoicheiometric equilibrium. The molecular weight of ZnS is 97.44 and the molecular weight of CdS is 144.47. A zinc cadmium sulfide containing 59.6 weight per cent of CdS is a crystal including one mol CdS for every mol ZnS. A crystalline luminescent material of this nature is particularly safe against ion bombardment.

The figure shows a curve representing by way of example the sensitivity of the luminescent material against ion bombardment in dependency of the CdS content. The ordinate represents the period of time of ion bombardment in hours after which the ion spot appears upon the luminescent screen and the abscissa shows the content of CdS in per cent. The curve has been found by experiments. A luminescent material of 60% CdS does not shown any blackening or darkening or loss of luminosity after 20 hours and more of operation.

A luminescent material of this type is by way of example produced in a process shortly described as follows: Zinc-sulfide is precipitated from a solution of zinc-nitrate by sulphuretted hydrogen. In a similar manner cadmium-sulfide is precipitated from a solution of cadmium-nitrate. The two substances are dried and finely pulverised and mixed in the correct proportion so that the two substances are in stoicheiometric equilibrium after their combination. The mixture is then placed into a crucible and sulphur is added in sufficient quantity. The charge is heated by any appropriate manner until the substances combine. The charge is then taken out after cooling and the core of the charge is used as luminescent material. A substance for making the crystalline powder not baking may be added.

A luminescent material of the described composition emanates a yellow light. In order to obtain a white colour it is preferable to add a luminescent material of complemental colour. This added component must also be insensitive to ion bombardment. It has been found that a material emitting white light is obtained if 70% of a ZnCdS material with a CdS content of 60% is mixed with 30% pure ZnS. A material of this type is sufficiently insensitive against ion bombardment provided that the mixture is not heated higher than 300° C after mixing. If the material is heated to a higher temperature a reaction takes place between the components and an ion spot will show after half an hour of operation. This result has a good coincidence with the measurements represented in the figure because by the

reaction a crystal with approximately 40% CdS is produced.

It is however also possible to obtain a material emitting white light which is absolutely safe against ion bombardment by mixing the components in such a manner that the final mixture contains one mol ZnS for every mol CdS. If in such a case a reaction takes place on account of high temperatures a stable crystal will be produced at least upon the surface of the screen so that the ion spot can not appear. Good results have been obtained with a mixture containing 20% ZnCdS with 20% CdS and 80% ZnCdS with 70% CdS. A material of this type shows white light with a very faint strawberry coloured shade. This material has been safe against ion bombardment after 20 hours of operation and more.

It is also possible to change the colour of the emitted light by adding activators so that any desired shades can be obtained.

The invention is not limited to the zinc-cadmium sulfide materials above mentioned which are particularly insensitive to ion bombardment and therefore very suitable as substances for producing luminescent screens of television receiving tubes. The invention relates also to all crystalline luminescent materials composed in a similar manner. In such materials the amount of the components is so chosen that the components are in stoicheiometric equilibrium so that the resultant crystal is safe against ion bombardment.

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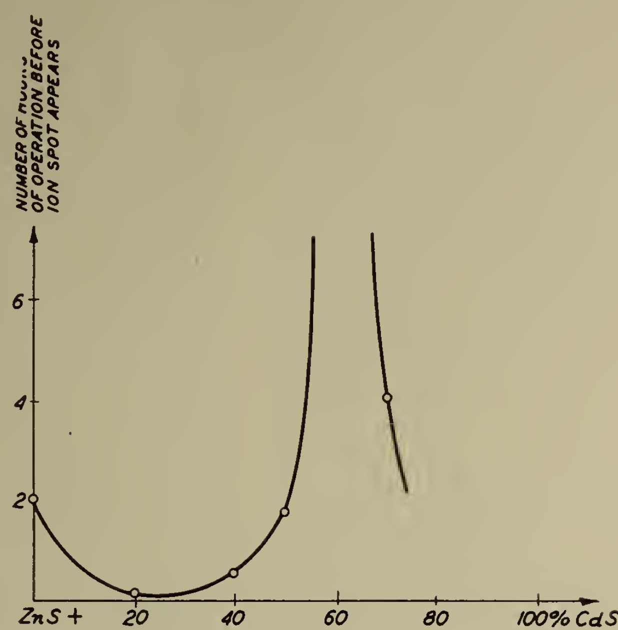

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ALIEN PROPERTY CUSTODIAN

APPARATUS FOR REMOVING PASS-DIFFERENCES

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Application filed January 8, 1942

The invention relates to an apparatus provided on the supplying table of a printing machine for avoiding pass-differences, which might occur and result from the alteration of the paper by physical influences, such as moisture and temperature.

It is a well known phenomenon that, for instance when carrying out multicolor printing, the printing sheet expands after each printing proceeding owing to the moisture taken up from the printing ink, and consequently the several successively printed on inks do not fit accurately the one on the other, so that a perfect printing result can not be obtained. The same inconvenience occurs when the percentage of moisture contained in the air alters owing to change of temperature.

An apparatus for removing this pass-difference has already become known, which is provided on the supplying table of the sheet feeding table of the sheet supplier of the printing machine. It consists of a fan-like tongue, composed of two parts and adjustable relative to the surface of the table in the height and in lateral direction, said tongue adapted to be adjusted so that the side edges of the sheet lifted by it and resting on the surface of the table can be brought into the correct position relative to the lay marks for passing through. This fan-like tongue is mounted in the middle of the feeding table, co-ordinated to the lay marks, so that the sheet to be printed can be lifted only in the middle. If, however, the differences in passing through exist only, viewed in the conveying direction, on the left or only on the right hand side of the sheet to be printed, it is not possible to avoid these passing differences with the aid of this apparatus. The same is valid, if the passing difference is greater or smaller on the one side or on the other side of the sheet to be printed than on the other side of the same.

This arrangement also possesses the inconvenience, that the front edge of the tongue terminates at a greater distance from the lay marks, and consequently the sheet is pulled back towards the rear from the lay marks at the parallel lifting of the tongue. The fan-shaped arrangement is further prejudicial in so far, as at the spreading of the two tongue-parts arranged the one above the other two different bearing planes are produced for the sheet, so that the sheet is lifted irregularly. The tongue adapted to be adjusted in lateral direction can also be adjusted only towards one side; therefrom results, however, a unilateral lifting of the sheet. All these inconveniences are avoided according to the invention in which no fan-shaped tongue is used.

According to the invention several small bars of sheet metal or the like are arranged on the feeding table of the printing machine in the conveying direction, the one at a distance from and parallel to the other and adjustable in height and adapted to be lowered into the plane of the feeding table, and further adapted to be lifted each one alone parallel above the surface of the table as also at an angle of inclination relative to the surface of the table, descending or ascending in the conveying direction according to the requirement for avoiding the pass-difference. The adjusting of the small bars can take place during the service.

An embodiment of the invention is illustrated by way of example in the accompanying drawing, in which

Fig. 1 shows in side elevation the apparatus on a feeding table for laying on by hand,

Fig. 2 a cross section through the apparatus, perpendicularly to the conveying direction,

Fig. 3 a top plan view of the apparatus,

Fig. 4 and 5 an adjusting device, in front elevation and side elevation respectively,

Figs. 6 to 10 several adjusting possibilities by means of the apparatus.

In the embodiment illustrated, the apparatus according to the invention is provided on a feeding table for hand feeding of a printing machine between the pile table **1** and the printing machine **2** on the inclined feeding table **3**. It is evident, that the apparatus may be used also in connection with a feeding table for automatic sheet supplying, in which the sheets are taken from a pile for instance by suction nozzles and fed by means of conveying bands onto the feeding table **3** of the printing machine **2**, the upper sides of these conveying bands moving in the plane of the table in grooves in the table.

The sheets are adjusted in known manner on the printing machine **2** on lay marks **4**, before they are taken over by the grippers of the printing cylinder.

According to the invention several bars **5**, **6**, **7** are mounted at a distance the one from the other and parallel the one to the other on the feeding table **3** in the direction of conveying indicated by an arrow A, the surface of said bars being normally in the same plane as the surface of the table **3**, so that these bars are located in indentations of the table **3**, and mounted so that each bar by itself can be raised parallel to the plane of the table **3**, as shown in Figs. 8 to 10, or adjusted at an angle to the surface of the table, either descending in the conveying direction as shown in Fig. 7 or ascending in this direction as

shown in Fig. 6. Each of the bars 5, 6, 7 which, for instance, are made of thin sheet metal, is fixed on a flat iron and this flat iron is fixed in turn on two U-shaped bearings 8 which are hingedly mounted on two rams 9 mounted below the feeding table. For each bar two rams 9 are provided, one ram in the front part and the other ram in the rear part of the bar. For each ram one adjusting device is provided. This adjusting device consists, as especially shown in Figs. 4 and 5, for instance of an adjusting wheel 10, arranged on a side of the feeding table 3, the spindle 11 of this adjusting wheel having flat screw-threads and engages in a spindle wheel 12, further a control mechanism 13, which is hingedly fixed on the one hand on the spindle wheel 12 and on the other hand on a catching disc 14. This segment-shaped catching disc 14 is mounted on the axle 15 so that it can freely move on the same, and it comprises a catch 16 which engages in a recess 17 in the ram 9. The rotary movement on the adjusting wheel is therefore positively transmitted upon the ram 9 by means of which ram in turn the bar is adjusted in vertical direction. The ram 9 is then guided between its bearings 18.

The invention provides further, that by the lifting of the bars the sheet lifted by the same can not bulge inwards behind the bars towards the front marks 4, wherefrom resulted up to the present that the sheet was drawn away from the front marks. With this object in view, an extension 5′, 6′, 7′ can be provided on each of the bars which is hingedly connected with the bars 5, 6, 7 so that the point of the extension, when the bar is lifted, remains in contact with the feeding table as shown on larger scale above the Fig. 1. The extension of the bar forms therefore a bridge for the lifted sheet, which consequently can not bulge inwards anymore. The bridge may also be formed thereby, that a transverse bar is provided which can be lowered into the feeding table and has an oblique surface, said transverse bar being adapted to be adjusted from below upwards so that the inclination descends in forward direction.

The avoiding of the pass-difference is effected by the apparatus according to the invention in the following manner:

If pass-differences have been ascertained on both sides of the sheet to be printed in transverse direction of said sheet, and these pass-differences become perceivable, regularly or irregularly on both sides, these can be avoided in that the two bars 5 and 7 are lifted more or less uniformly or irregularly, whereby the sheet 19 to be printed, indicated in dash-dot lines, is more or less shortened in width at both sides uniformly or more on the one side and less on the other side. If only little pass-differences occurred uniformly on both sides of the sheet it is sufficient, to raise only the middle bar. At pass-differences occurring in the longitudinal direction of the sheet, i. e. in the direction of conveying, the bars are adjusted accordingly obliquely, whereby the sheet is pulled back on the lay marks or pushed forward, according to whether the bars have been inclined at an ascending or at a descending angle. If pass-differences have been ascertained only on that side of the sheet which is at the right hand side in the conveying direction, these pass-differences can be regulatad either by uniform lifting of the bar 5 or by adjusting this bar at an angle. The bar 7 must be adjusted accordingly, if pass-differences have to be corrected on the left hand side of the sheet. In this instance the middle bar 6 may also be used. The attendant can therefore use the bars according to requirement and is in the position, to carry out all corrections which are necessary for overcoming pass-differences merely by corresponding adjusting of the bars.

After the adjusting of the bars, the sheet 19 to be printed is no longer laying plane on the feeding table 3, but slight bulges are produced in the sheet to be printed, and the corners of the sheet to be printed are either pulled back or pushed forward on the gripper edge.

By the employment of the apparatus the operation of the lay marks is not altered in any manner nor impaired. The bulgings in the sheet to be printed are removed during the rolling of the printing cylinder by the counter pressure of the counter pressure cylinder produced at the transmission of the picture to be printed, this being favored thereby, that the paper absorbs moisture during the printing and thereby becomes less resistant and more yieldable.

GEORG SPIESS.

PUBLISHED
MAY 25, 1943.
BY A. P. C.

G. SPIESS
APPARATUS FOR REMOVING PASS DIFFERENCES
Filed Jan. 8, 1942

Serial No.
426,025
2 Sheets-Sheet 1

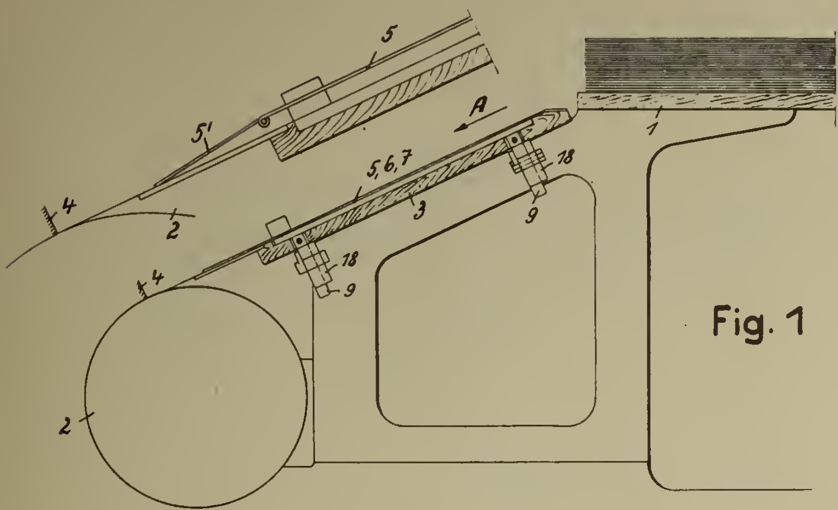


Fig. 1

Fig. 2

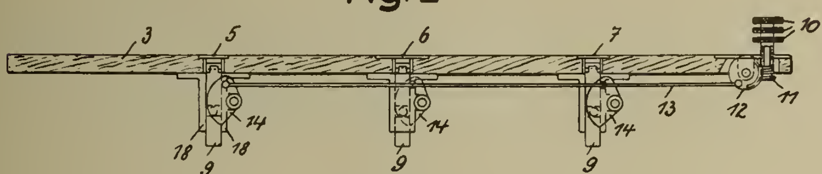
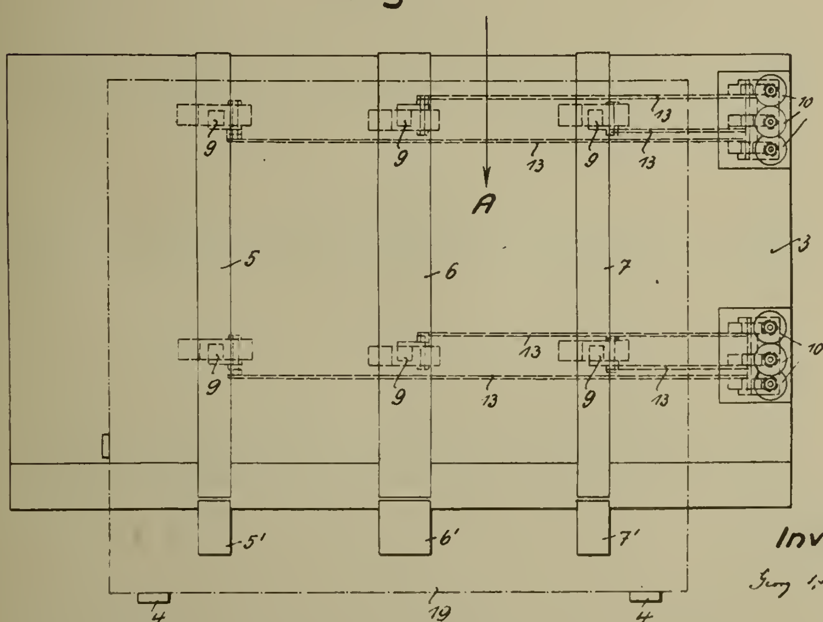


Fig. 3



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by
[signature]
his Attorney

PUBLISHED | G. SPIESS | Serial No.
MAY 25, 1943. | APPARATUS FOR REMOVING PASS DIFFERENCES | 426,025
BY A. P. C. | Filed Jan. 8, 1942 | 2 Sheets-Sheet 2

Fig. 4

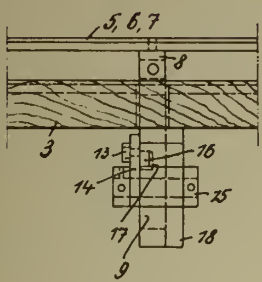


Fig. 5

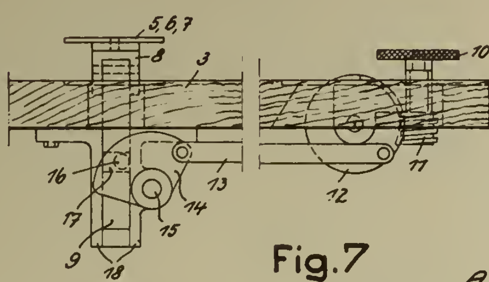


Fig. 7

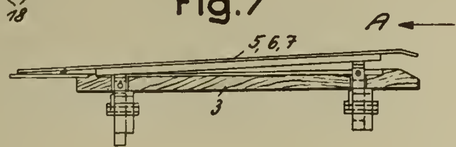


Fig. 6

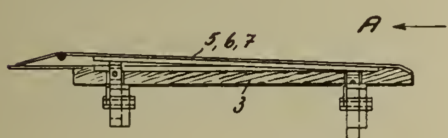


Fig. 8

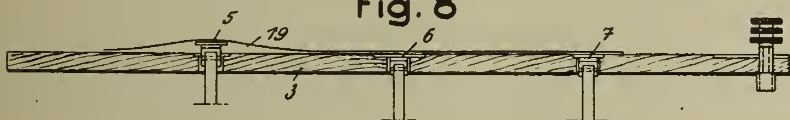


Fig. 9

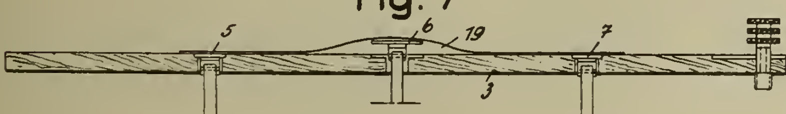
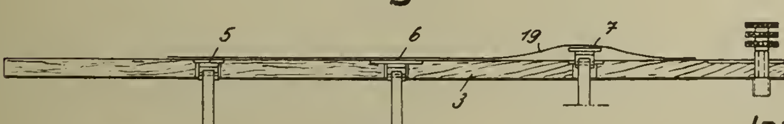


Fig. 10



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Published May 25, 1943 Serial No. 426,254

ALIEN PROPERTY CUSTODIAN

PROCESS FOR LAUNDERING WITH HARD WATER AND SOAP OR OTHER LAUNDERING AGENTS, AND MEANS FOR PERFORMING SAID PROCESS

Laurits Thorkild Schouboe Madsen, Holte, Denmark; vested in the Alien Property Custodian

No Drawing. Application filed January 9, 1942

In laundering with soap or other laundering agents in hard water the difficulty has always been met with that the hardness producers of the water, especially calcium salts, precipitate a portion of the soap as insoluble fatty-acid salts, the result being partly a rather considerable loss of soap and a corresponding reduction of the laundering capacity of the laundering agents, and partly an incrustation in the laundered cloth, impairing its appearance and reducing its wearing quality.

In order to remedy these drawbacks, filtering through base-exchanging substances has been resorted to and, especially in households and smaller laundries, alkaline active substances, for instance soda, have been used, in order to soften the water, the said substances, when added to the laundering water, precipitating gradually the calcium salts.

These reactions, however, take place very slowly at the ordinary temperature (10 to 20° C) of service water. In order to promote the speed of reaction, the water has been passed over crystalline calcium carbonate, especially marble, as a catalyst, but in that case apparatuses are also required which render the use of the process expensive and unpractical, when only smaller quantities of water are concerned. Some alkaline reacting substances, for instance normal sodium phosphate react certainly rather quickly, without the presence of any such catalyst, but the precipitate produced is subject to the drawback that it reacts highly with soap, in such a manner that a considerable quantity of the latter will be wasted, unless the precipitate be removed, before the soap is added.

No satisfactory agent for softening smaller quantities of water, for instance for household use (cloth-laundering, dish-washing) or the like, has heretofore been known.

The present invention having for its object to solve this problem is based on the fact that the softening process of the washing water by means of alkalies and, consequently the entire laundering process, may be accelerated considerably by adding to the water, before the soap or other laundering agents sensitive to the hardness are dissolved in the same, of certain solid finely comminuted insoluble substances accelerating the process, for instance crystalline or micro-crystalline calcium carbonate or, maybe, also magnesium carbonate. A characteristic feature of the present invention is that the precipitate is not removed, since it possesses, as demonstrated by the inventor, the highly important technical property that it does not react with soap. Instead of the pure salts, we may also use minerals containing the said salts, for instance marble, dolomite, limestone or chalk in powdered state. The soap, or other washing agents sensitive to the hardness, may be added to the washing water simultaneously with, or after, the addition of the alkalies and the said reaction-promoting substances, the said substances being used in a suitable slowly soluble state, if the laundering agents sensitive to the hardness are added simultaneously with the hardness-removing agents.

As appearing from the following examples, the process referred to here renders practicable the removal of hardness from water by means of alkaline reacting substances, with the formation of reaction products that are inactive to soap or other laundering agents, in a small fraction of the otherwise required time, and without this process requiring any special apparatuses.

Examples

In the following experiments, water of 19 German degrees of hardness and a temperature of 12° C was used, with an addition of 1,5 grams of calcined soda per liter. If merely the said quantity of soda is added, no softening will be noticeable after the lapse of ten minutes. If at the same time calcium carbonate in a sufficiently comminuted state is added, the softening will be accelerated considerably.

The below mentioned quantities of calcium carbonate have been found to be able to cause the softening to be finished (viz. to about 3 or 4 degrees of hardness) within the periods mentioned:

Calcium carbonate	Period of hardness removal
	Minutes
0,02 grams per liter	12
0,04 grams per liter	5
0,08 grams per liter	3
0,20 grams per liter	1½

This shows that the process according to my invention will render harmless the hardness-producers, within a very short time to the same extent that is attainable by ordinary water softening by means of chemicals. In the examples soap is used, but the invention may also be employed for softening of water used for laundering with other washing agents that might be influenced unfavourably by the hardness in the water.

It should be noted that instead of calcium carbonate or magnesium carbonate, also numerous other solid finely crystalline or micro-crystalline insoluble substances may be useful.

LAURITS THORKILD SCHOUBOE MADSEN.

Published May 25, 1943

Serial No. 427,599

ALIEN PROPERTY CUSTODIAN

AERIAL SYSTEMS

Tjiske Douma, Eindhoven, Holland; vested in the Alien Property Custodian

Application filed January 21, 1942

For the transmission or reception of television, as well as for definite systems of altimetry and obstacle detection in which use is made of a high carrier-wave frequency, it is necessary to utilize aerial systems which, in contradistinction to a simple dipole aerial, have an impedance of which the absolute value for a frequency range of about 10% of the carrier-wave frequency varies by 10% at most.

For such purposes it is known to utilize a dipole aerial system constituted by two conical metal bodies having their points adjacent one another.

A drawback of this cone aerial is the complicated and voluminous construction which is necessary to obtain a sufficient structural rigidity and which renders the aerial system comparatively expensive; moreover, it has a shape which is unsuitable for mounting on an airplane.

The invention has for its object an aerial system of simple and cheap construction which is suitable for the above mentioned purposes.

To this end, in an aerial system comprising at least two radiators arranged adjacent to and parallel with one another, of which the interval therebetween is small relatively to the length of the radiators, while short-circuits are provided between the corresponding extremities of the radiators. Each of the said short-circuits, according to the invention, is so made that it extends over part of the length of the radiators so that, as viewed in the longitudinal direction of the radiators, points of one of the radiators located next to one another, and in the proximity of the extremities are connected by it directly to similarly located points of the other of the radiators.

The aerial system according to the invention is preferably utilized at a wavelength which is equal to about double the length of a radiator.

It has been found that, considering the object aimed at, a very advantageous form of the impedance-frequency curve of the aerial system is obtained if each of the said short circuits, as viewed in the longitudinal direction of the radiators, extends over a distance larger than $\frac{1}{20}$ and smaller than $\frac{1}{5}$ of the length of a radiator.

Each of the short-circuits is preferably constituted by a plane metal plate located in or at least substantially in a plane surface defined by two of the radiators.

A particularly advantageous impedance-frequency curve of the aerial system according to the invention is obtained by using two radiators, one of the two radiators being constituted by a metal band whose width is preferably smaller than the interval of the two radiators, the other of the two radiators being interrupted in the center and connected to a transmission line.

In order that the invention may be more clearly understood and readily carried into effect, it will be explained more fully by reference to the accompanying drawing.

Figure 1 shows a known aerial system for comparison with the aerial system according to the invention.

Figures 2 and 3 show advantageous forms of construction of aerial systems according to the invention.

In Figure 4 the impedance-frequency curves of the aerial systems shown in Figures 1, 2 and 3 are represented for wavelengths corresponding to about double the length of a radiator.

The known aerial system shown in Figure 1 is constituted by three radiators 1, 2 and 3 which are arranged adjacent to and parallel with one another and whose length is substantially equal to half of the wavelength utilized. The central one of the radiators (2) is interrupted in its center and connected to a transmission line 4 which is connected to a non-represented transmitter or receiver. Short-circuits 5 are provided between corresponding extremities of the radiators.

As may be assumed as known, the radiators of such an aerial system are excited with equal phase and consequently in the case of resonance of such a "three-fold dipole" the impedance is about 9 times as great as the resonance impedance of a simple dipole.

In Figure 4 the absolute value of the impedance of the aerial system of Figure 1, as viewed from the transmission line, is represented as a function of frequency by the curve I. It appears therefrom that it greatly varies in the vicinity of the resonance frequency of the aerial which is about 71 megacycles/sec.

The aerial system according to the invention shown in Figure 2, like the aerial system shown in Figure 1, is constituted by three radiators 6, 7, 8 respectively which are arranged adjacent to and parallel with one another and of which the central one is interrupted and connected to a transmission line 9. Here again the radiators are short-circuited at their extremities, but in contradistinction to the aerial system shown in Figure 1 the short-circuits of the corresponding extremities of the radiators are brought about by plane plates 10 which are located in the plane surface common to all radiators. Each of these plates brings about a short-circuit which extends over part of the length of the radiators, thus

connecting points of one of the radiators located next to one another and in the vicinity of the extremities directly to similarly located points of the other radiators.

As appears from the impedance-frequency curve II measured for the aerial system shown in Figure 2, the maximum variation of the aerial impedance, if the carrier-wave frequency of the oscillations to be transmitted or to be received is about 61 megacycles/sec., for a frequency range of about 10% of the carrier-wave frequencies (58–64 megacycles/sec.) is smaller than 8% of the average impedance of the aerial.

A still more advantageous form of the impedance curve of the aerial system according to the invention is obtained with the aid of the aerial system shown in Figure 3 which consists of two radiators. According to this form of construction, the extremities of the two radiators 11 and 12 are connected together by metal plates 13 located in the plane surface comprising the two radiators, said connection being effected over a distance which is about $\frac{1}{10}$ of the length of a radiator, or about $\frac{1}{20}$ of the wavelength utilized, as in the form of construction shown in Figure 2. However, in this form, the upper one of the two radiators (11) consists of a metal band whose width is less than the interval between the radiators. The other of the two radiators (12) is interrupted in its center and connected to the extremities of the transmission line 14.

In Figure 4, III is the impedance-frequency curve of the aerial system shown in Figure 3. It appears therefrom that for a frequency range of more than 10% of the average frequency, viz. 8 megacycles/sec. (56–64 megacycles/sec.), the maximum variation of the aerial impedance is less than 1%, i. e., that the aerial impedance for practical purposes may be considered as constant.

It may further be remarked that the absolute value of the impedance of the aerial system shown in Figure 3, which consists of two radiators, is approximately equal to that of the aerial system shown in Figure 2 which consists of three radiators. In both cases this impedance is about 700 ohms, which value is particularly advantageous in view of the adaptation of the impedance of the aerial system to that of the transmission line.

TJISKE DOUMA.

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MAY 25, 1943.
BY A. P. C.

T. DOUMA
AERIAL SYSTEMS
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427,599

Fig. 1

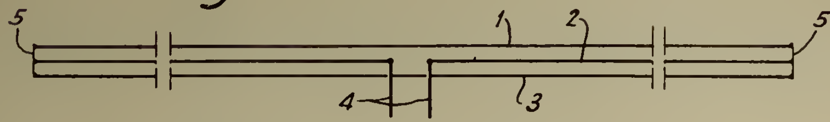


Fig. 2

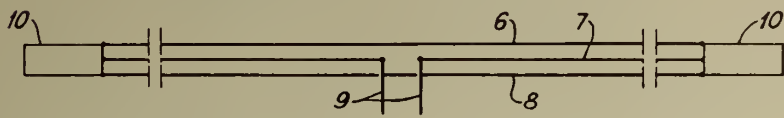
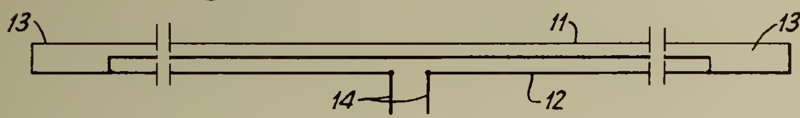


Fig. 3



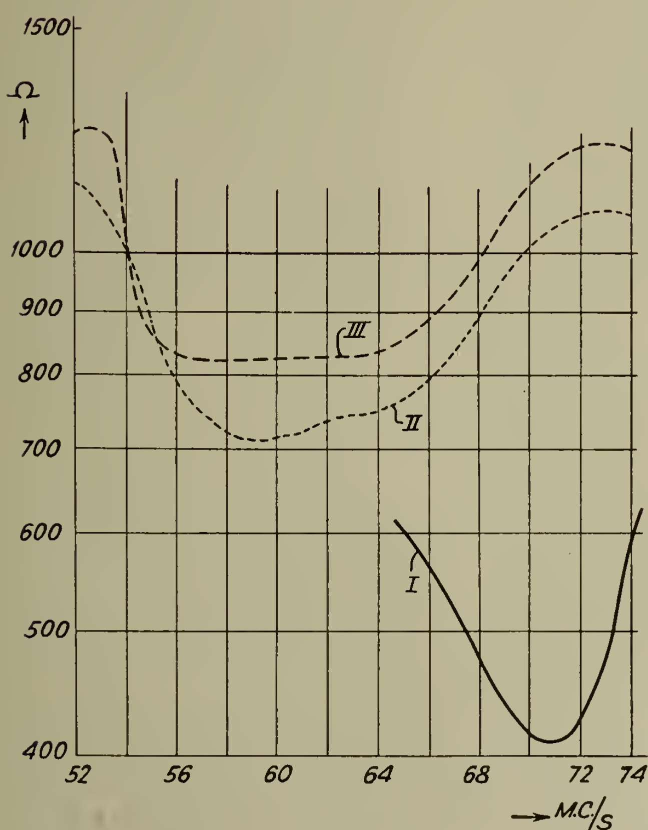


Fig. 4

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Published May 25, 1943 Serial No. 430,602

ALIEN PROPERTY CUSTODIAN

ELECTRIC DISCHARGE TUBES

Frederik Coeterier, Eindhoven, Holland; vested in the Alien Property Custodian

Application filed February 12, 1942

For various purposes high-vacuum discharge tubes are required in which narrow, sharply limited electron beams are generated. Such tubes are found in apparatus for oscillography and those for television, and also in modern generator tubes for ultra-short waves use is made of narrow electron beams. More particularly in the latter case it is essential that a sharply limited beam having the maximum possible current density should be generated, from which strongly concentrated space-charges can be formed by means of speed modulation in order to bring about strong current impulses in an oscillatory circuit.

Different means are known whereby in cathode-ray tubes for television and oscillography it has been endeavoured to concentrate the electrons emitted by the cathode immediately after they pass out of the emissive surface so that no electrons get lost. It has previously been suggested to surround the cathode by a coil which is traversed by a current, in order to avoid the dispersion of the electrons by the magnetic field thus excited. This only permits of obtaining a poor result since the magnetic field of such a coil is generally too homogeneous to bring about an effective concentration of the cathode rays.

The invention has for its purpose to eliminate this drawback and to obtain a strong concentration of the electrons in the form of an electron beam with great current density. According to the invention, for this purpose the cathode is surrounded by a ferric magnetic body which is magnetically polarised in the direction of the electron beam. At the end of this body the magnetic field is greatly unhomogeneous so that it forces the electrons to move to the axis of the system.

The magnetically polarised body may be a permanent hollow magnet, or it may be a ferric magnetic body which is magnetised by a magnet coil or in another manner.

In order to avoid as much as possible stray of the electrons, in the further development of the tube according to the invention it is aimed at causing the electric lines of force, which also determines the paths of the electrons, to coincide as much as possible with the lines of force of the concentrating magnetic field.

For this reason it is desirable that the emissive surface of the cathode should be arranged near the mouth of the polarised body, i. e. in the region wherein the axial component of the magnetic field reverses its direction, while it is further desirable to use a concave emissive surface so that the electric field converges immediately.

An advantageous shape of the electric lines of force may be prompted by giving the magnetic body a potential which is negative relatively to the cathode so that this body also serves as a Wehnelt cylinder.

The invention will be more clearly understood by reference to the accompanying drawing showing, by way of example, a sketch of an electrode system for generating a directional electron beam for a discharge tube according to the invention.

The system is constituted by a cathode **1**, preferably an indirectly heated incandescent cathode, as usual, a grid shaped control electrode **2** and a first anode **3**. The cathode is surrounded by a cylinder **4** of ferric magnetic material whose edge **5** exhibits a magentic pole. The body **4** may be a permanent magnet or it may be surrounded by a coil, if desired outside the wall of the tube not shown in the figure, so that it can be traversed by an electric current to magnetise the cylinder **4**.

A potential difference set up between the cathode **1** and the body **4**, due to which the potential of the latter is rendered negative relatively to that of the cathode promotes the convergence of the electric lines of force which pass out of the emissive surface of the cathode and are even at their origin directed to the axis **6** of the system due to the concave shape of the said surface.

Assuming that the pole **5** is a north pole, the magnetic lines of force within the body **4** run from the edge backwards, i. e. in the figure from the left to the right. In front of the cathode, i. e. in the figure at the left of the cathode **1**, they run from the right to the left. Consequently, a strong unhomogeneity of the magnetic field occurs at the mouth of the body **4**, in front of the cathode, in contradistinction to the magnetic field of the magnet coil which has in the past been suggested for a similar purpose.

Due to the concave shape of the emissive surface of the cathode and the arrangement of the various elements of the system relatively to each other it is achieved that the velocity of the electrons does not acquire a strong component normal to the magnetic lines of force so that at the point where the magnetic field in the region traversed by the electrons is most convergent and has the greatest field-intensity, the electron paths can slightly deviate from the magnetic lines of force.

This results in that a large cathode surface can be used of, say, 150 mm^2 and that a comparatively great current can be obtained, for example 0.5 to 1 amp., and a very small loss through stray electrons.

It is advisable that the beam should be kept

concentrated by a homogeneous axially magnetic field in order to avoid defocussing through repulsion and the like.

The described system is highly adapted to be used in generator tubes with directional electron beams for ultra-short waves. It may also serve excellently in cathode-ray tubes for the reception of electrically transmitted pictures and more particularly in such tubes which serve for the projection of the transmitted picture with an enlarged size, for which a great luminous intensity and hence a great current is required.

FREDERIK COETERIER.

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BY A. P. C.

F. COETERIER
ELECTRIC DISCHARGE TUBES
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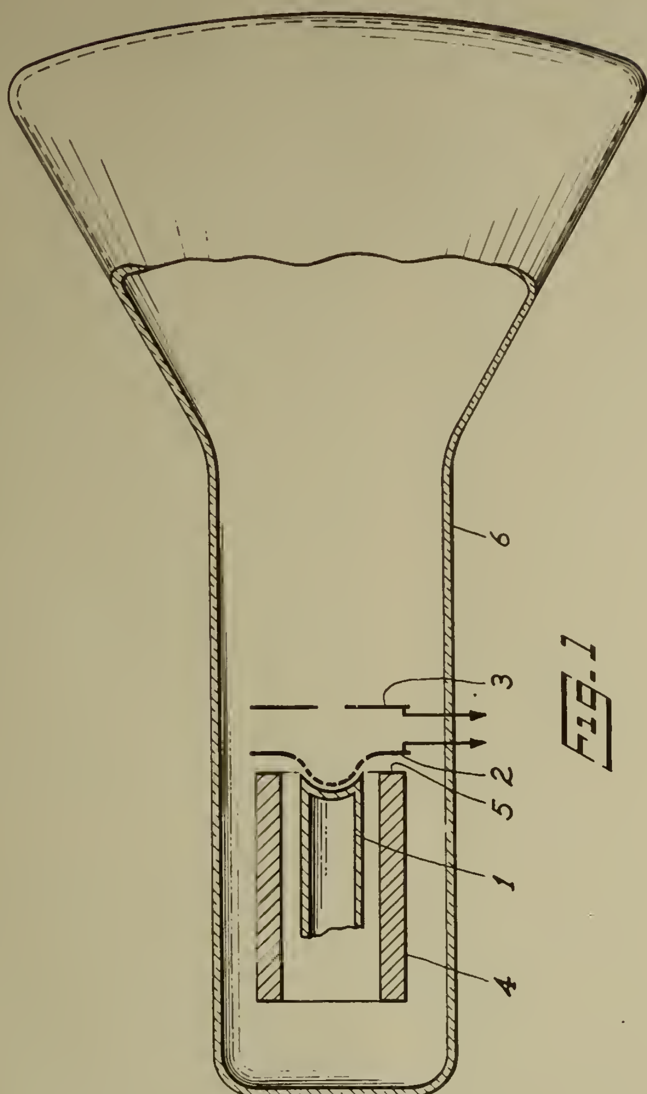

Fig. 1

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Published May 25, 1943

Serial No. 430,821

ALIEN PROPERTY CUSTODIAN

CONSTRUCTION OF RETRACTABLE LANDING GEAR

Raymond Saulnier, Paris, France; vested in the Alien Property Custodian

Application filed February 13, 1942

The present invention relates to retractable landing gears of the type including a shock absorber which carries the wheel, pivoted to a fixed point of the airplane structure and maintained in the landing or extended position by a breakable strut pivoted on the one hand to a fixed point of the airplane and, on the other hand, to a point of the shock absorber.

The invention relates more particularly to landing gears of this type, in which the point at which the strut is pivoted to the shock absorber is located close to the lower end of the cylinder of the shock absorber, which ensures a very good resistance during landing.

In a more specific manner, the invention relates to retractable landing gears in which the strut is made of two portions pivoted to each other substantially at the middle point of the strut, in such a manner that, when the gear is in the landing position, the point of articulation of the two portions of the strut passes beyond the dead center position, so as to improve safety when landing, independently of the locking of the strut.

According to the invention, the folding or retracting of the landing gear is effected in two steps, the first of which consists, after the strut has been released, in breaking it so as to cause, in the particular case just above mentioned, the point of articulation to pass on the other side of the dead center line, the second step being performed by the action of a jack pivoted on the one hand to a fixed point of the airplane and, on the other hand, to the end of a lever rigid with the shock absorber, so as to cause the latter to pivot about the point at which it is mounted on the airplane.

One of the most serious difficulties which have to be dealt with in retractable landing gears, is to ensure the retraction of the gear with the minimum of efforts, which implies an efficient utilization of the power of the retracting means.

An object of the present invention is to provide a retracting device such that the first step, which starts the breaking of the strut, and the second step which causes the shock absorber to pivot about its point of articulation on the airplane, are produced by a thrust directed along a line making an angle as small as possible with the optimum direction, account being taken of the efforts to be exerted.

For this purpose, according to a feature of my invention, the strut includes a system of levers intended to break this strut and, in particular, to move the point of articulation thereof from one side to the other of the dead center line.

According to another feature of the invention, the lifting device proper is arranged in such manner that the lever arm on which the jack is to act increases, during the lifting movement, as the resistance itself increases, whereby the effort to be supplied by the jack never reaches very high values, since the force to be exerted at the end of the movement is relatively small.

Other features of my invention will result from the following detailed description of some specific embodiments thereof.

Preferred embodiments of my invention will be hereinafter described, with reference to the accompanying drawings, given merely by way of example and in which:

Fig. 1 is a diagrammatic front view of a landing gear made according to the invention;

Fig. 2 is a detailed view showing on an enlarged scale the means for releasing the strut and breaking it;

Fig. 3 is a view similar to Fig. 1, showing another embodiment of the invention;

Fig. 4 is a detailed view showing on an enlarged scale the valve of the operating jack used in connection with the device of Fig. 3.

In the embodiments of Figs. 1 and 2, G is the shock absorber which carries a wheel W and is pivoted at H to a fixed part M of the airplane. The shock absorber may be maintained or not in its plane, parallel to the fore-and-aft plane of symmetry of the airplane, by a thrust bar, the latter being eventually pivoted to a fixed part of the airplane at a point located behind point H, so that the whole can pivot about a longitudinal axis passing through these two points. The landing gear further includes a strut constituted by two portions A and A′ pivoted to each other near the middle point thereof at B. These two portions are locked in the landing position by a locking member C which is shown in a more detailed manner by Fig. 2. This locking member is preferably controlled pneumatically by a valve D. E and F are the points where the strut is pivoted to the airplane and to the shock absorber respectively.

The retraction of the landing gear is obtained by rotating shock absorber G about point H, this movement being produced by the action of a jack V, one of the ends of which is pivoted to the airplane at a point J, while the other end is pivoted to an arm I rigid with the shock absorber.

Reference character T designates the operating

member, N is the compressed air inlet, K a distributer for controlling the inflow of oil under pressure and Q a conduit through which oil is fed to the distributor. Distributor K is further connected through pipes K^1 and K^2 to the respective ends of jack V. Finally, valve D is connected through a pipe *d* to a pneumatic piston P housed in strut A, A'.

This device will work in the following manner:

The first movement of the operating lever T, in the direction of arrow f^1, opens valve D, which causes compressed air to be fed into pipe *d*. Pneumatic piston P is actuated by this compressed air and pushes lever L, pivoted about an axis O, so as to bring the locking member C rigid with lever L (see Fig. 2), into inoperative position.

When the strut has been released, during the second part of the same movement, a projection R of lever L strikes a corresponding projection R' of portion A' of the strut, whereby the thrust of piston P breaks the strut just when the two projections disengage from each other. At this time, the movement of piston P is stopped by a lug U. During this movement, the point B about which the two portions of the strut are pivoted to each other, passes from a position below line E—F (where it was jammed in order to increase safety in case of non-operation of the locking means) to the position B' on the other side of said line E—F. The operating lever T is now at the end of its displacement in the direction of arrow f^1.

The second movement of this operating lever T, in the direction of arrow f^2, has for its effect to open, through distributer K, the inlet of oil under pressure, which passes through conduit K^1 into jack V, which pushes lever I and causes, by rotation of the shock absorber, the landing gear to be fully folded by the breaking of strut A—A'.

In the example which has just been described, the operating lever T is given two successive movements, one serving to control the pneumatic piston which starts the breaking of the strut, and the other operating the jack, which finishes the lifting operation.

In the embodiment shown by Fig. 3, the pneumatic control valve D is located between jack V and the point J of fixation thereof to the airplane. In this embodiment, the operation of the lifting device is simplified since it suffices to control the distributer K of oil under pressure.

When the operating lever X of Fig. 3 is moved, oil under pressure is fed through conduit K^1 to the jack, which tends to push lever I, on the one hand, and to open valve D on the other hand. As lever I resists the thrust thus transmitted thereto, because strut A—A' is locked and therefore cannot break, jack V compresses spring Y (see Fig. 4) and permits valve D to open. The compressed air fed through inlet N to this valve acts on piston P, brings locking member C into inoperative position and starts the breaking of the strut in the way above explained. The jack now bears against a piece Z, provided in the valve for limiting the movement, and lifts the shock absorber by pushing lever I.

The landing gear according to the invention has many advantages, among which the following may be cited:

First, the safety obtained when landing is very high, since the shock absorber is well adapted to resist transverse stresses, as it is held at a very low level by the strut. Furthermore, the latter cannot break accidentally since, even when it is not positively locked, said strut is blocked in the extended position by the compression stresses, in view of the position occupied by articulation B with respect to the direction E—F of the stresses. Therefore there is practically no risk of an accidental folding of the gear during landing, even under the most difficult conditions.

On the other hand, the landing gear is also very safe concerning the unfolding thereof. This operation is ensured by the weight of the landing gear, the counter-pressure in the jack and elastic cable S acting on strut A—A'.

Another advantage of the landing gear, according to the invention, consists in the fact that the stresses necessary for lifting the gear are reduced to a minimum. As above explained, the first movement, which starts the breaking of the strut, while unlocking it, necessitates but a very small effort in view of the particular arrangement of the levers and the projections carried by the parts of the strut. Furthermore, the lever arm, on which the lifting jack is acting, increases with the effort to be supplied, as above explained.

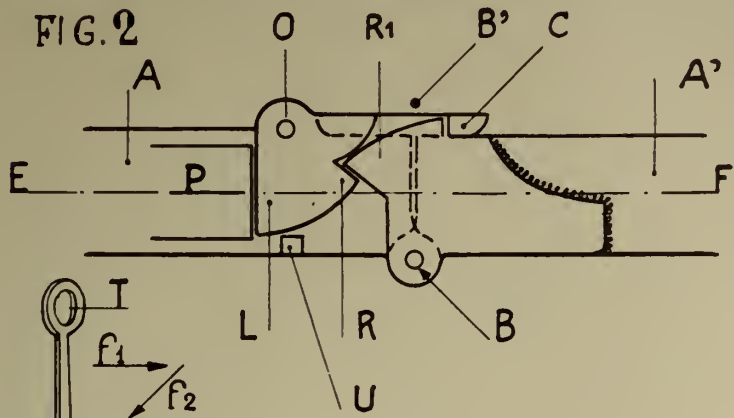
RAYMOND SAULNIER.

PUBLISHED
MAY 25, 1943.
BY A. P. C.

R. SAULNIER
CONSTRUCTION OF RETRACTABLE LANDING GEAR
Filed Feb. 13, 1942

Serial No.
430,821
2 Sheets-Sheet 1

FIG. 2



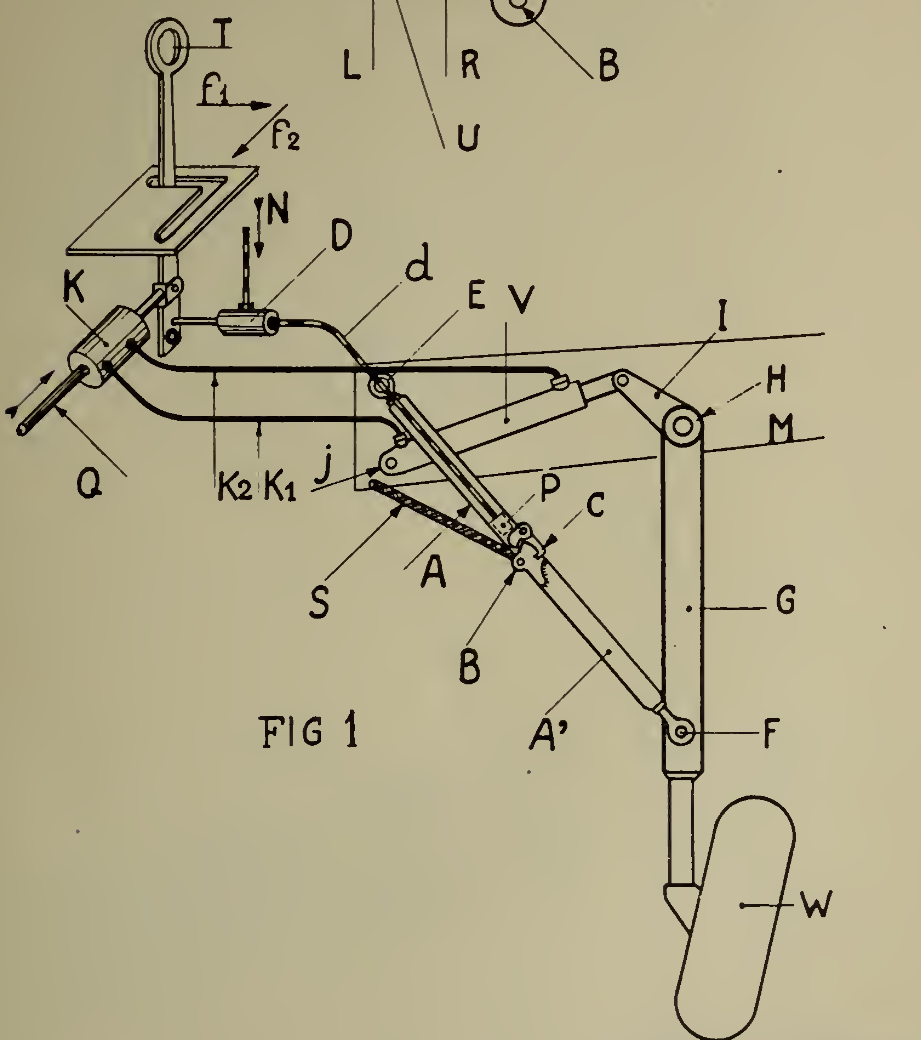


FIG 1

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2 Sheets-Sheet 2

FIG. 3

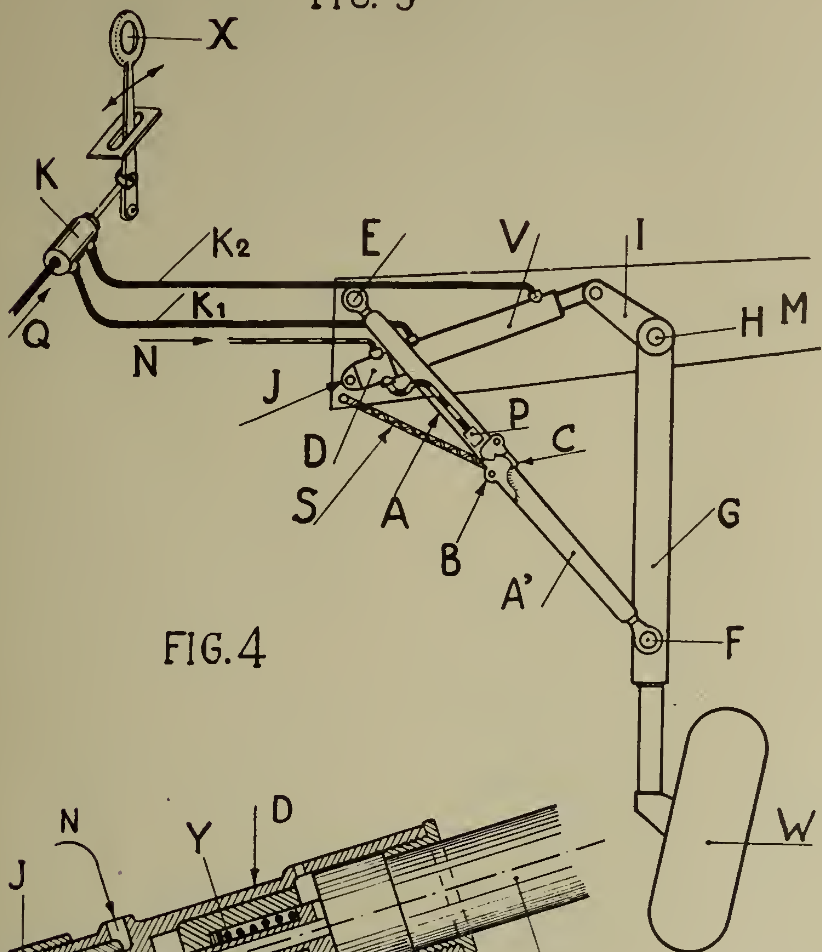
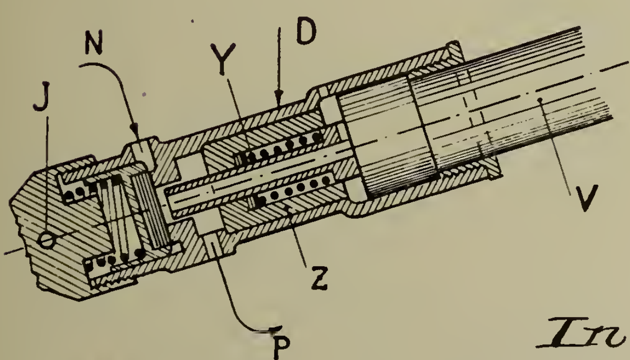


FIG. 4



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Published May 25, 1943

Serial No. 430,970

ALIEN PROPERTY CUSTODIAN

RETRACTABLE TAIL LANDING GEARS FOR AIRCRAFT

Charles Raymond Waseige, Rueil, France; vested in the Alien Property Custodian

Application filed February 14, 1942

This invention relates to retractable tail landing gears for aircraft of the kind comprising a wheel or the like carried by a supporting frame, acting as a shock-absorber, and mounted as to be able to swing between a low or working position and a high or retracted position in response to the operation of a suitable controlling means; and more particularly to the landing gears of this type in which said controlling means comprises a spring device (pneumatic jack or the like) which is constantly under tension and accumulates energy during the lifting movement in order to restore it during the lowering movement, and locking systems for assuring the maintaining of the supporting frame in either position.

In such tail landing gears, it is important that the locking system for locking the supporting frame in its low position be not only able to firmly and safely maintain the supporting frame when the aircraft rolls on the ground but that it be able to easily unlocking said frame when it is desired to retract the landing gear to its high position after taking-off.

It has been suggested, in view of effecting this locking, to use a tilting member, pivoted to turn around a horizontal axis to the aircraft structure, for capping the end sheath of the supporting frame in its working position. A safe locking may thus be obtained. However, in view of the fact that the end sheath of the supporting frame applies with great pressure upon the supporting area of this tilting member when transmitting to the latter the strains to which said frame is subjected, the power necessary for lifting said tilting member and unlocking said frame may attain considerable values.

One of the objects of this invention is to remove the drawbacks of the known devices and to provide a locking system which is of simple construction, which safely maintains the landing gear in working position and which requires but a small power for unlocking the supporting frame in order to effect the lifting thereof.

In accordance to this invention, the sheath end of the supporting frame in working position is held pressed against the bottom of a substantially horizontal U-shaped or the like socket formed in a bracket member, by a spring device, and is retained in this position by a block closing at least partially the opening of said socket, said block being urged towards its working position but being adapted to be retracted, preferably by a swinging motion, on the one hand automatically, near the end of the lowering travel of the landing gear, so as not to hinder the lowering of said gear to its working position, and on the other hand in response to the operation of a controlling device, when the gear is operated for lifting.

According to a feature that this invention may further embody, said block is combined with a locking bolt co-operating with the sheath of the supporting frame for locking automatically these two parts together as the gear reaches its low position.

A single control preferably assures successively the retraction of the bolt and that of the block.

This single control may be so correlated with that of the gear lifting mechanism that the latter operates only subsequent to the retraction of the block.

In a preferred embodiment, the locking bolt is carried by the block and an electromagnet operates a rocking cam which co-operates with the tail of said bolt and is so shaped that, responsive to the cam, said tail causes the bolt to slide and retract until arrested by an abutment, and then to swing together with said block, a contactor being preferably provided for closing the circuit of the lifting mechanism at the end of the travel of said electro-magnet.

Other features and advantages of the invention will moreover be apparent from the description hereinafter given as an example with reference to the annexed drawing, in which:

Fig. 1 is a schematic elevational view of a tail landing gear according to this invention;

Figs. 2 and 3 show at a larger scale, partially broken, the device for holding the gear both in working position and in retracted position;

Fig. 4 is a plan view of this device.

In accordance with the embodiment shown, the landing gear comprises a supporting frame **1**, acting as a shock absorber, the upper part of which terminates into a cylindrical sheath **3** and the lower part of which carries a landing wheel **4**, protected by a mudguard **5**. The supporting frame **1** is mounted in a clamp collar **7** keyed to the shaft **8** of the lifting mechanism, of any suitable type, contained in a housing **10**, by means of which mechanism said frame can be lifted to its high position, shown by chain dotted lines in Fig. 1.

The frame **1** is held in its high position by a locking device consisting of a keeper **12**, a co-operating finger **13** carried by the mudguard and a hand controlled operating device **15** for disengaging the keeper.

A spring device, such as the pneumatic jack 16, which is constantly under tension and accumulates power during lifting, is connected to the clamp collar 7 so as to control the lowering of the landing gear. The whole device may be of any known type and will need no further description.

In the working position, the landing gear comes to rest at the bottom of a horizontal U-shaped socket 19 and is held pressed against said bottom by the jack 16. The socket 19 is formed in a bracket member 20 supported by a shaft 21 mounted on the structure of the aircraft, said bracket being locked relatively to the housing 10 by means of an arm 22, of adjustable length. The U-socket 19 is closed on the open side by a block or shoe member 25 the inner end of which is shaped to conform with the sheath 3 in working position. Said block 25 is fulcrumed on a pivot pin 26 located across the limbs which define the socket 19 in bracket 20 and secured at the end thereof to said bracket. A spring 28 located between one ear of the block 25 and a projection 30 on member 20 urges said block in the direction of its working position. A longitudinal bore provided in the block 25 serves as a guide for a sliding bolt 32 the head 35 of which is urged outwardly by a spring 33. The bolt head 35 co-acts with a slot or groove 36 provided on one side of sheath 3.

The sliding movement of the bolt 32 towards the rear is limited by an adjustable abutment formed by the end of a screw 38 co-operating with a screwthread provided in the block 25 beyond the bolt 32. The latter has a tail 40 projecting upwardly and co-operating with a rounded cam 42 keyed to a pivot 44. This pivot is supported vertically above the pivot 26 by a pair of ears 45 on bracket 20 and carries one arm 46 to which is pivoted a link 48 connected with the core of an electromagnet 49 the frame of which is flanged to the bracket 20. Said core is integrally connected with a contactor 52 adapted to bridge two contacts 53 at the end of its travel, said contacts being mounted in series in the control circuit of the lifting mechanism. A plunger switch 55 attached to the bracket 20 is adapted to be closed by the frame 1 when the sheath 3 comes to rest at the bottom of socket 19.

The relative positions and sizes of the various elements are such that the energizing of the electromagnet responsive to the operation of the landing gear lifting mechanism causes the landing gear to operate as follows, starting from its low position, as shown in Figs. 1 and 2, where it is pressed against the bottom of the socket 19 by the constantly tensioned jack 16.

In the first part of the core travel the cam 42 repels the tail 40, which causes the bolt 32 to slide until it engages with the abutment screw 38, thereupon said cam imparts to the block 25 a swinging movement around its pivot, this being facilitated by the rounded form of the cam. The parts are then in the position shown in Fig. 3 and, on reaching the end of its travel, the magnet core bridges the contacts 53, thus closing the circuit of the landing gear lifting mechanism. When the landing gear reaches its high position in which it remains locked, as shown in Fig. 1, the control circuit is opened, the block then returning to its low position under spring action.

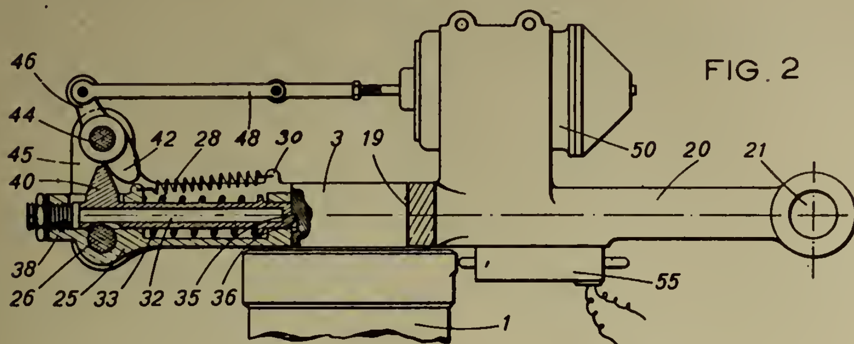
To lower the gear, the control 15 is operated in view of unlocking same, when the jack 16 or the like brings it back to its working position. As the sheath 3 engages with the block 25, said block will be lifted thereby against the action of spring 28 and as said sheath comes into rest at the bottom of socket 19, the block 25 falls back and the bolt 35 is then projected into the groove 36 by its spring 33. The landing gear is thus locked in its low position.

At the same time, the contactor 55 also effects the closing of a circuit for controlling an indicator device of any suitable type.

CHARLES RAYMOND WASEIGE.

PUBLISHED | C. R. WASEIGE | Serial No.
MAY 25, 1943. | RETRACTABLE TAIL LANDING GEARS FOR AIRCRAFT | 430,970
BY A. P. C. | Filed Feb. 14, 1942

FIG. 2



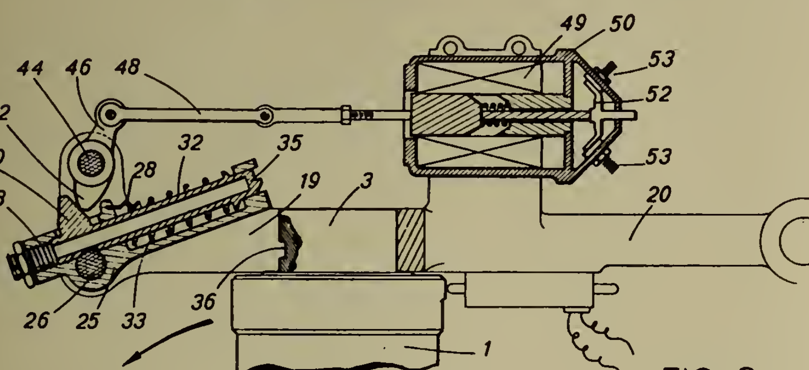


FIG. 3

FIG. 1

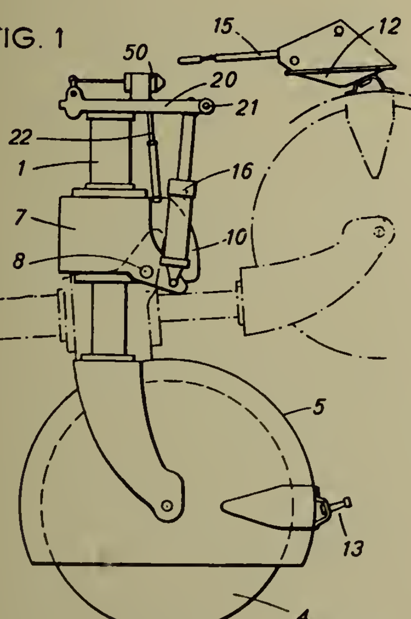
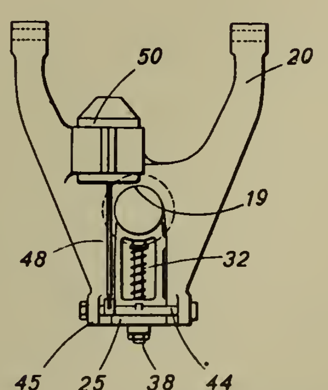


FIG. 4



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Published May 25, 1943 Serial No. 431,435

ALIEN PROPERTY CUSTODIAN

GOVERNORS

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Application filed February 18, 1942

The invention relates to speed-responsive regulators, and, in particular, to speed-responsive regulators for use in connection with power transmissions.

With speed-responsive regulators heretofore known and used in connection with the shifting of speed gears, it is necessary to shift the gears by hand or mechanically in response to the magnitude of a certain factor of operation. The shifting operation by hand has the drawback that to much reliance is placed upon the operator who is likely to change the speed too early or too late, thereby causing the driving motor to work uneconomically.

The known mechanical or automatic speed changing devices are normally rather complicated and particularly objectionable for the reason that at one and the same driving speed they may shift upwardly as well as downwardly, with the result that they tend to swing back and forth at the desired shifting or speed changing point.

Therefore, it is an object of the invention to provide a speed-responsive regulator for power transmissions, in which the speed shifting points are stabilized, thereby preventing the tendency of previous speed-responsive devices to oscillate at the speed shifting points.

It is another object of the invention to provide a speed-responsive regulator for effecting the speed change of power transmissions, in which the point at which the shifting up from one speed to another speed takes place, differs from that point at which the shifting down from the last mentioned speed to the first mentioned speed is effected.

It is a further object of the invention to provide a speed-responsive regulator for power transmissions in which the shifting up from one speed to the next higher speed is effected at a driving speed which is higher than the speed at which the reverse shifting movement is effected.

Still another object of the invention is to provide a speed-responsive regulator in connection with hydraulic power transmissions, in which the speed regulator operates controlling means which directly control the supply of driving fluid to said power transmissions.

A still further object of the invention consists in the provision of a speed-responsive regulator in combination with a control system for power transmissions in which the speed-responsive regulator, by the intervention of pilot means, operates controlling means controlling the supply of driving fluid to the power transmission pertaining thereto.

These and other objects and advantages of the invention will appear more clearly from the following specification in connection with the accompanying drawings, in which:

Figure 1 is a graph illustrating the principle of the invention.

Figure 2 shows a hydraulic power transmission in connection with a speed-responsive regulator according to the invention.

Figure 3 is a first embodiment of a speed-responsive regulator according to the invention, and

Figure 4 is a second embodiment of the invention.

The present application is a divisional of my copending application, Serial No. 360,333, filed October 8, 1940.

General arrangement

The stabilization of the speed shifting points, i. e., the separation of the point at which shifting up is effected from the point at which the shifting downward operation is initiated, is obtained according to the present invention by the provision of a labile regulator, that is, a governor in which a predetermined centrifugal force acting upon a rotating mass or body is overcome by the action of one or more springs of labile characteristic. To more clearly elucidate this point, reference may be had to the graph of Figure 1.

The centrifugal force produced by the rotating mass of a regulator or governor is ordinarily designated C, while the distance from the center of the rotating mass to the axis of rotation is ordinarily designated x. If now the centrifugal forces C, which may be determined by calculation or experiments, are plotted as ordinates of curves and the corresponding distances x are plotted as abscissae, the regulating curves obtained are the so-called C curves showing the characteristics of the regulator or governor. From such C curves the operating characteristics of the regulator may be obtained without any further information.

In order to determine the operating characteristics of a C curve, a straight line is drawn from the origin of the co-ordinates to different points on the respective C curve. If, with an increasing distance x, the angle between the said straight lines and the abscissae increases, the regulator or governor is said to possess stabilizing characteristics. If, with an increasing distance x the said angle remains the same, the regulator or governor is said to possess astatic operating characteristics. If, however, with an increasing distance x the angle between the said straight lines and the abscissae decreases, the governor or regu-

lator is said to possess labile operating characteristics.

Figure 1 shows three curves of labile, stabile, and astatic characteristics. Whether the governor or regulator operates as a stabile, astatic or labile regulator depends on the selection of characteristics of its loading spring or springs. According to the present invention, the loading spring or springs must have such characteristics as to produce a labile regulator operation in the sense of the above explanation.

Due to the provision of a regulator with labile characteristic, according to the present invention, it has been made possible to separate the point at which the shifting up from one speed to the next higher speed is effected, from the point at which the reverse shifting movement is initiated. More specifically, according to the present invention, the shifting up operation from one speed to another speed is effected at a driving speed which is higher than the driving speed at which the reverse shifting operation becomes effective. The difference in the driving speed between two adjacent change-over points for upward and downward shifting can be established through a corresponding choice of the spring characteristics.

Structural arrangement

Referring to Figure 2, 1 designates a speed governor according to the present invention which is adapted to reciprocate a valve member generally designated 2. The valve member 2 comprises a shaft 3 smoothly fitting in a bore 4 and connected with a shaft 5 of smaller diameter which carries three spaced pistons 6, 7 and 8 respectively. The shaft 5 includes a longitudinal bore 9 with transverse bores 10, 11 and 12. The shaft 5 with the pistons 6, 7 and 8 is reciprocably mounted in the bore 4 for controlling ports 13, 14, 15 and 16.

The port 13 is connected with a conduit 17 leading to the hydraulic torque converter 18 which is provided with an impeller 40, a runner 41 and a guide wheel 42.

The port 14 communicates through the conduit 19 with the coupling 20 comprising an impeller 43 and a runner 44.

The port 15 is connected with a conduit 21 leading to the hydraulic coupling 22 having an impeller 45 and a runner 46.

Finally, the port 16 is connected by means of the conduit 23 with a filling pump 24 which is actuated by the driving shaft 25 of a motor 26 through the intervention of a beveled gear 27, 28 and a shaft 29 carrying the latter.

The impellers of the converter 18 and couplings 20 and 22 are connected with the shaft 30 which is drivingly connected with the beveled gear 27. The runners of the converter and couplings are drivingly connected with the shaft 31 having rigidly mounted thereon, a pulley 32, which by means of a belt 33 drives a pulley 34 of the regulator 1. Also rigidly connected with the shaft 31 is a beveled gear 35 adapted to cooperate with the beveled gears 36 and 37 provided on the axle 38 carrying the wheels 39.

As will be seen from Figure 2, the position of the pistons 6, 7 and 8 controls the supply of fluid from the filling pump 24 to the converter and the couplings for filling the same with driving fluid. When the supply of driving fluid to the couplings is interrupted due to the position of the valve member 2, the driving fluid in said couplings will be discharged through bores 47 and 48 positioned therein. Also the torque converter 18 is emptied in a similar manner when the supply of fluid thereto is shut off.

Referring now to Figure 3 illustrating the first embodiment of the speed regulator according to the invention, it will be noted that the pulley 34, driven by the secondary shaft 31 and the pulley 32, is rigidly connected with the regulator shaft 49 by means of a key. The regulator shaft 49 is fixed to a rotating casing 50, which comprises grooves 51 having slidably mounted therein centrifugal masses or bodies 52. The centrifugal bodies 52 are covered by a dish-shaped disc 53 which is adapted to be maintained under pressure of the springs 54 and 55 and to be lifted against the thrust of said springs when the centrifugal force acting upon the masses or bodies 52 causes the latter to swing about the lowermost point of their supports 57. One spring governs the shifting operation from a first speed to a second speed and vice versa, while both springs govern the shifting operation from the second speed to the third speed and vice versa.

In the embodiment of Figure 3, the spring 54 comes into operation at the first control range and allows the masses or bodies 52 to move under the influence of the centrifugal force until their movement is stopped by the engagement of the member 56 with the stop 58. The member 56 is supported by the dish-shaped disc 53 and the upper portion 59 of the control piston 60 carried by the disc 53. The upward movement of the disc 53 lifts the control piston 60 connected therewith accordingly.

The control piston 60 has three valve head portions 61, 62 and 63 separated from each other by piston shaft portions 64 and 65 of smaller diameter than the valve head portions 61, 62 and 63. The valve head portions 61, 62 and 63 are smoothly fitting and reciprocably mounted in a bore 66 of a casing 67 surrounding the rotating casing 50. The casing 67 includes a port 68 communicating through a passageway 69 with an enlarged annular portion 70 of the bore 66. Similarly, the casing 67 includes a port 71 communicating through a passageway 72 with an enlarged annular portion 73 of the bore 66.

Furthermore, the port 74 in the casing 67 communicates with the bore 66 through a passageway 75. The piston shaft portions 64 and 65 are provided with transverse bores 76 and 77 respectively which communicate with each other through a longitudinal bore 78 passing through the lower end of the valve head portion 63, so that fluid may pass from the longitudinal bore 78 into the bore 66 below the valve head portion 63, and from there into the conduit 79.

When the driving speed and thereby the centrifugal force acting upon the centrifugal masses 52 has increased to a predetermined extent, a second spring 55 will be compressed by the upward movement of the disc 53 until the member 80 supporting the lower end of the spring 55 engages the stop 81. Consequently, the control piston 60 then occupies a position different from that position in which only the first spring was compressed. The control piston 60 is so arranged that it is balanced and that only slight force is necessary for effecting a sliding movement thereof.

The hydraulic circuit associated with the speed-responsive regulator of Figure 3 also comprises a fluid supply pump 82 from which leads a pressure conduit 83 to the main control valve 84 in which three valve pistons 85, 86 and 87 are

reciprocably mounted. From the filling conduit **83** branches off a regulating conduit **88** leading to the port **74** of the regulator casing **67** and including a shutoff valve **89**. So long as the valve **89** is closed, the conduits **90** and **91** respectively communicating with the ports **68** and **71** and leading to the main control valve **84** and the conduit **79** likewise leading to the main control valve **84** are without pressure fluid. In this instance, the valve pistons **85**, **86** and **87** are forced toward the right-hand end positions by springs **92** and **93** housed in the main control valve **84** so that the flow of pressure fluid from the supply pump **82** through the conduit **83** is blocked.

The piston **86** controls, in addition to the intake port **94** communicating with the conduit **83**, the discharge port **95** communicating with the conduit **96** leading to a torque converter **18** illustrated in Figure 2. The piston **87** with the piston portions **97** and **98**, controls the ports **99** and **100** respectively communicating with conduits **101**, **102** leading to couplings **22** and **20**, as likewise illustrated in Figure 2.

As will be seen from the above, the control piston **60** of the embodiment of Figure 3 takes the place of a pilot piston, whereas in Figure 2 the control piston **2** directly controls the supply of fluid to the converter and couplings.

Figure 4 shows a modification of the invention, as illustrated in Figure 3, in which the centrifugal masses **52** are mounted between separate discs **103** and **104** loaded respectively by springs **106** and **105** which impose different restoring forces. The arms **57** are pivotally connected with the respective masses **52** so as to allow outward movement thereof when a predetermined centrifugal force acts upon said masses. Furthermore, the control piston **60** of Figure 3 is replaced by two separate pistons **107** and **108**, in which the piston **107** is slidably mounted in the piston **108**. In this instance, each piston opens ducts to individual turbo circuits, in other words, one piston controls the conduit **90** of Figure 3, while the other piston controls the conduit **91** of Figure 3. Otherwise, the parts of Figure 4 correspond to those of Figure 3 and are, therefore, designated with the same reference numerals so that no further description thereof is necessary.

Operation

Supposing the valve **89** is opened by the vehicle operator and the regulator valve plunger **60** and its associated parts are positioned as shown in Figure 3. Pressure fluid then passes through the conduit **88**, the valve **89** and the port **74** in the casing **67**, from where the fluid passes through the bores **76**, **78** and **66** into the conduit **79**. The fluid will then act upon the piston **85** in the main valve **84** and move the piston **85** together with the piston **86** into the position shown in Figure 3. When this occurs, a fluid connection is established between the filling conduit **83** and the conduit **96** leading to the torque converter **18**, whereupon the latter while rotating fills with fluid and imparts a predetermined speed upon the wheels **39**.

When the driving speed now rises to the point where the centrifugal masses or bodies of the regulator compress the loading spring **54** as far as the abutment or stop **58** then the control piston **60**, connected to the regulating disc or sleeve **53**, is shifted by a sufficient amount so that pressure fluid can now pass from the conduit **88** through bore **78** into the conduit **90**. The piston **86** in the main control valve **84** will then be shifted to the left, and the fluid supply for filling the conduit **102** of the power transmitter **20** will be released. The power transmitter **20** will then be filled with fluid while the supply of fluid to torque converter **18** is shut off and the converter is emptied so that a higher speed is imparted upon the wheels **39**.

With a further increase in the speed of rotation, the control piston **60** is lifted still further, thereby establishing communication between the port **74** and the annular recess **73**. As a result, pressure fluid from the pump **82** passes through the conduit **88**, the port **74**, the conduit **72**, and the port **71** into the conduit **91**, from where the fluid passes into the valve **84** where it acts upon the piston **87** so as to shift the latter to the left. In this position, it blocks the supply of fluid to the fluid power transmitter **20** and releases fluid to the fluid power transmitter **22**. In this manner, the change of motion is performed in a complete automatic way depending upon the speed.

The coupling circuits are emptied by discharge ports **47**, **48** through which, during operation, a limited quantity of fluid is passed from the coupling circuits into a tank for cooling purposes and replaced by the filling pump **82**. The converter circuit is emptied through similar discharge ports. When the fluid supply to any turbo circuit is interrupted due to the shifting of the control valve **60**, this turbo circuit is emptied by centrifugal force through its discharge ports.

The operation of the arrangement of Figure 2 is similar to that of Figure 3. However, while in Figure 3 the movement of the centrifugal masses **52** and the control piston **60** operated thereby, control the main control valve **84** which in its turn controls the fluid supply to the several transmitters, the control piston **2** of Figure 2, directly controls the supply of pressure fluid from the filling pump **24** to the respective transmitter.

The operation of the modification shown in Figure 4 differs from that of Figure 3 merely in that first the weaker spring **105** is compressed when the masses **52**, due to the centrifugal forces acting thereupon, move outwardly until the disc **104** with its shoulder **104a** abuts the casing **50**, whereupon further outward movement of the masses **52** causes the latter to depress the piston **108** against the thrust of the stronger spring **106**. Consequently, piston **107**, corresponding to piston **61** of Figure 3, acts first and the piston **108**, corresponding to piston **62** of Figure 3, comes into action when the centrifugal force has increased to a predetermined value. In other words, the movement of piston **107** controls the fluid supply to the conduit **90**, while the piston **108** controls the fluid supply to the conduit **91**.

To illustrate the different stages during an actual shifting operation, reference may again be had to Figure 1, and for the sake of simplicity, it may be assumed that the regulator works without friction while the weight of the centrifugal masses **52** and the control piston **60** is to be considered as a portion of the load acting upon the springs.

It may further be assumed that the vehicle is driving with a speed of 950 revolutions per minute, while the actual shifting movement is to be effected at 1000 revolutions per minute. While at a driving speed of 950 revolutions per minute, with the spring in its expanded position, the

spring load will be higher than the centrifugal force, the situation materially changes with the increase of the driving speed.

It is characteristic for a labile regulator that the increase in the spring load with increasing driving speed is less than the increase in the centrifugal force acting upon the centrifugal masses. When the driving speed now increases it will finally reach a value say 975 revolutions per minute; here the spring load equals the centrifugal force. As a mere example, it may be assumed that at the driving speed of 975 revolutions per minute, the spring load and the centrifugal force is 5 lbs. Since now the spring load is balanced, only a slight increase in the centrifugal force is required to overcome the thrust of the spring and to lift the control piston **60** suddenly until the member **56** abuts the stop **58**.

In the above example, it may be said that this sudden lifting and shifting movement will be effected at 1000 revolutions per minute when the centrifugal force has increased from 5 lbs. at 975 revolutions per minute to 6 lbs., while for the same speed range the increase of the spring load is only 0.5 lbs. so that the spring load is now 5.5 lbs. After this shifting movement, the speed may increase beyond 1000 revolutions per minute.

If now the driving speed decreases, for instance due to driving up a hill, the shifting down movement will not be effected at 1000 revolutions per minute because at this driving speed the centrifugal force is still greater than the spring load, namely by 0.5 lbs. as set forth above. For the shifting down movement, it is therefore necessary that the driving speed still further decreases so that the spring load becomes greater than the centrifugal force which, in the above example, will be below the driving speed of 975 revolutions per minute.

In case the speed has increased beyond 1000 revolutions per minute and reached a predetermined value, for instance 2000 revolutions per minute, at which the second shift is desired, the shifting operation will take place in a similar manner as described above. In other words, the centrifugal force will have increased at that time to a materially greater extent than the total spring load of both springs **54** and **55** or **105** and **106**, so that the second piston **62** (Figure 3) or **108** (Figure 4) becomes effective. The downward shifting operation will, however, not take place at 2000 revolutions per minute, but below this value, for the reasons set forth above.

As will be clear from the above, the provision of a speed-responsive regulator with labile characteristic in connection with a power transmission according to the invention, separates the shifting up and shifting down points, so that the swinging back and forth adjacent the shifting points, as encountered with previous speed-responsive regulators, is avoided.

While the drawings illustrate the invention in connection with two springs, that is, for three speeds, it is of course understood that the invention is by no means limited to the employment of two springs for three speeds.

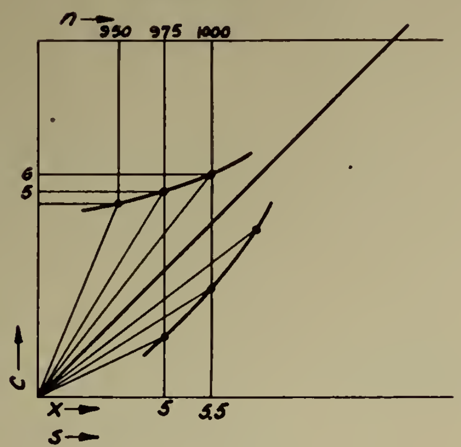
HUGO KIESER.

PUBLISHED MAY 25, 1943. BY A. P. C.

H. KIESER
GOVERNORS
Filed Feb. 18, 1942

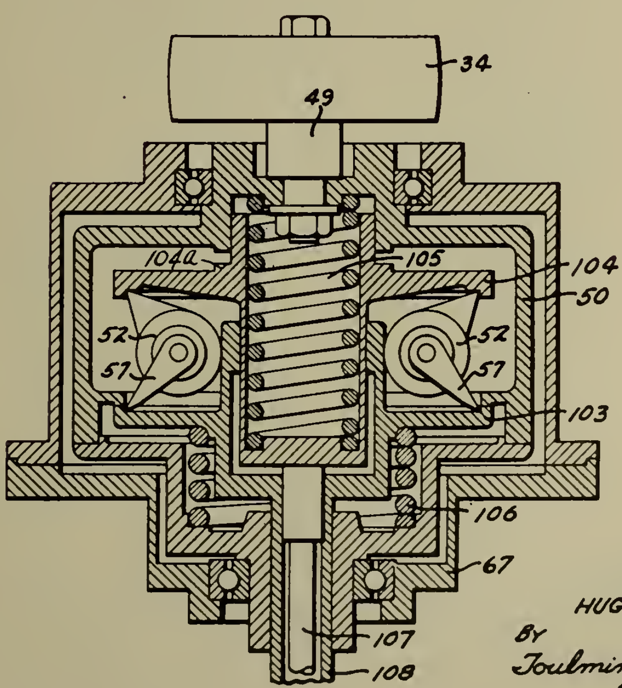
Serial No. 431,435
3 Sheets-Sheet 1

FIG. 1



X = DISTANCE BETWEEN THE CENTER OF THE MASSES SUBJECTED TO CENTRIFUGAL FORCE AND THE AXIS OF ROTATION OF SAID MASSES
S = SPRING LOAD IN POUNDS
n = DRIVING SPEED IN R.P.M.
C = CENTRIFUGAL FORCE IN POUNDS

FIG. 4



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PUBLISHED
MAY 25, 1943.
BY A. P. C.

H. KIESER

GOVERNORS

Filed Feb. 18, 1942

Serial No.
431,435

3 Sheets-Sheet 2

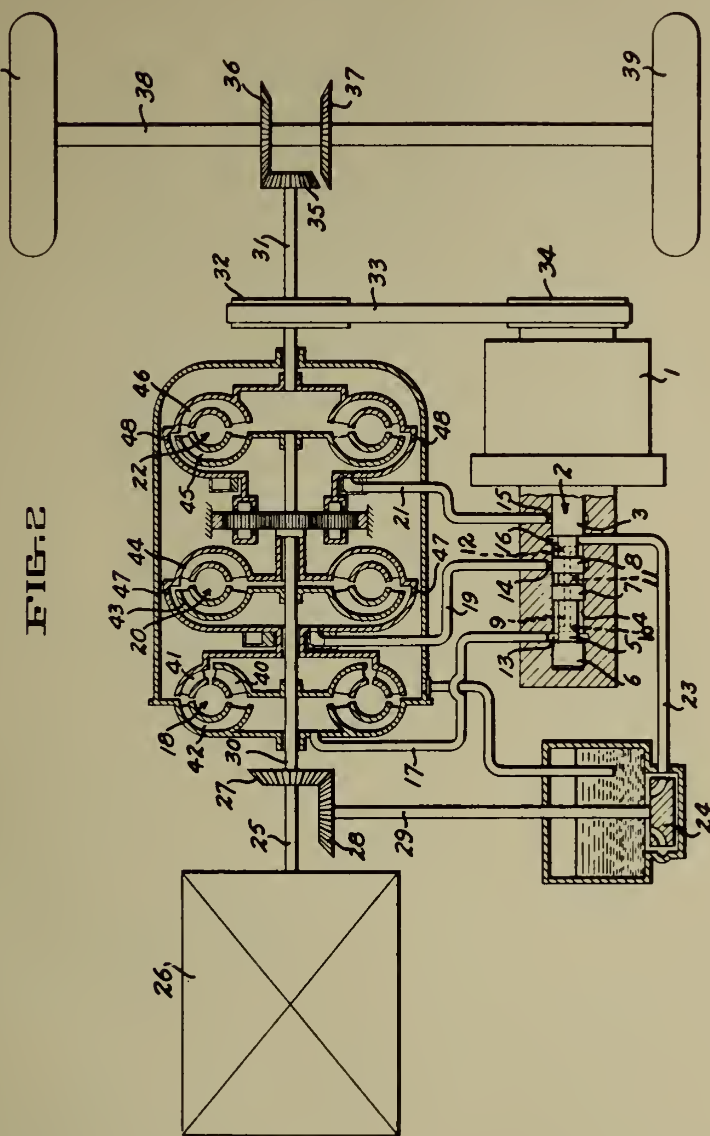

FIG. 2

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Serial No.
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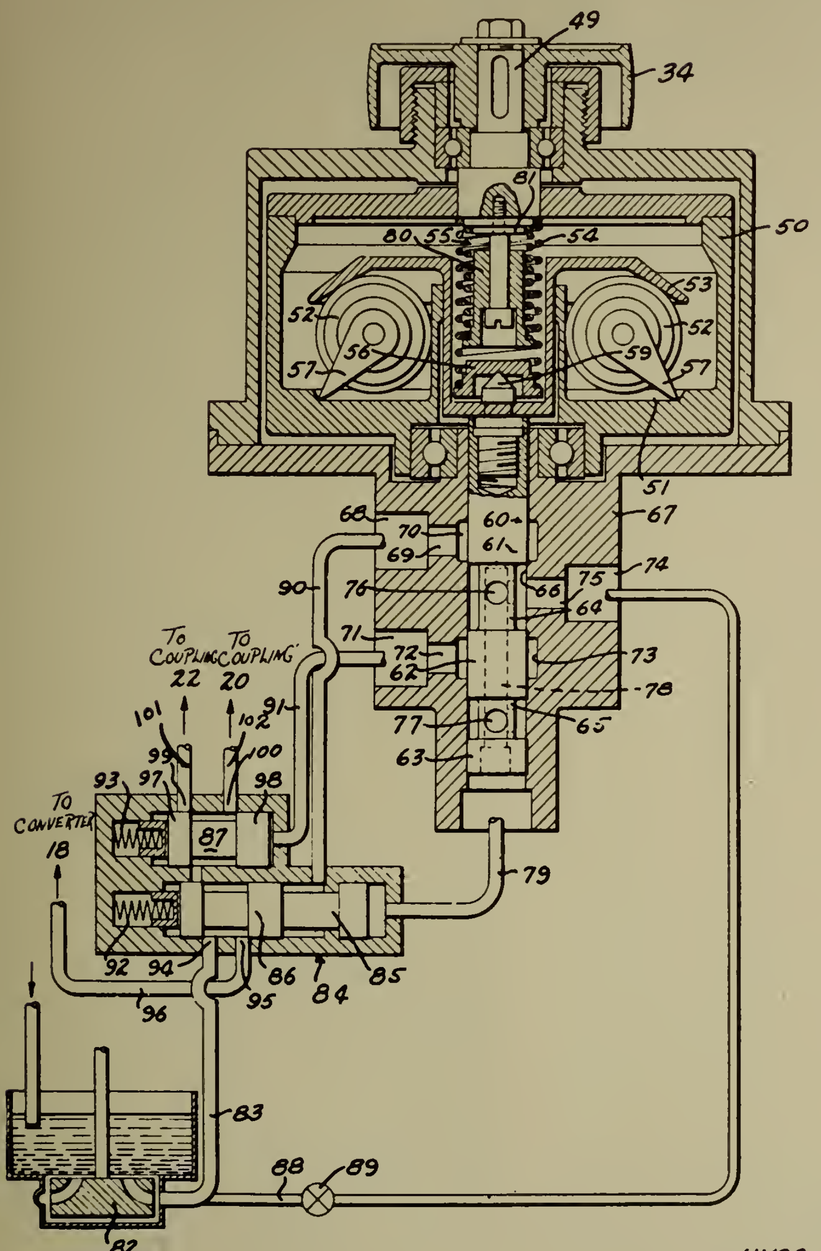
3 Sheets-Sheet 3

FIG. 3



INVENTOR
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Published May 25, 1943 Serial No. 433,386

ALIEN PROPERTY CUSTODIAN

PROJECTORS

Ettore Salani, Rome, Italy; vested in the Alien Property Custodian

Application filed March 4, 1942

When a projector is required for a special purpose, for example for illuminating a building, or an extended area, such as a landing field for aircraft, it is necessary to adapt it very exactly to the purpose in view so as to obtain the desired effect, in the first case by producing different luminous intensities on particular parts of the building such as the ends, according to their nature, and in the second case so as to obtain a uniform distribution of the light over the whole of the illuminated surface.

For the purpose of obtaining this result it has hitherto been usual to employ separately or in groups projectors with parabolic reflectors having a curvature which more or less concentrates the reflected rays or even projectors of any suitable shape which are combined with refracting elements located in the path of the projected beams. The effect obtained by these means is either the formation of a more or less open cone occasionally approaching the shape of a cylinder, or the diffusion in the form of a fan in a single plane. In any case, with these means it has not been possible to adapt the projected light with sufficient precision to the nature of the object to be illuminated, and especially, when using refracting elements, the cost of production is excessive for the purpose in view. On the other hand, known projectors, as a rule require the employment of very strong luminous sources consuming much power for obtaining the desired effect.

The present invention concerns a projector for eliminating the disadvantages referred to. It comprises a single luminous source and is composed of a plurality of similar reflecting elements which are juxtaposed and are constituted by portions of bodies of general cylindrical shape, as parabolic cylinders, the dimensions of each element and its position relatively to the adjacent elements being determined by the luminous intensity desired in the different portions of the projected luminous beam, which intensity is obtained by superposition in the same zone of rays reflected by a plurality of elements.

An object of my invention is to provide selective intense illumination of extended facades and large public structures.

Another object of my invention is to provide a plural reflected beam illumination system wherein beams reflected from one side of the system cross beams reflected from the other side of the system, before incidence on the illuminated structure.

A further object of my invention is to provide a projector system utilizing a single light source and a single supply line for electric power.

Still another object of my invention is to provide a projector system wherein substantially all of the light flux is directed upon the portions of the structure which it is desired to illuminate, and which consumes a minimum amount of electric power for a given amount of desired illumination.

A still further object of my invention is to provide a projector system using metal reflecting elements cut into flat substantially rectangular strips and formed into individual desired shapes.

My invention will be better understood by reference to the following specification and accompanying drawings, wherein:

Fig. 1 shows in transverse horizontal section the arrangement to form a single projector of nine reflecting elements, and the respective boundaries of the individual reflected beams, wherein the beams reflected from elements on one side of the central axis of the system cross the beams reflected from elements on the other side thereof.

Fig. 2 shows for the arrangement of Fig. 1 the superposition pattern of the individual reflected beams as incident on the illuminated structure.

Fig. 3 shows in transverse horizontal section a modification of the arrangement of Fig. 1, wherein the beam reflected from each element has its outer boundary parallel to the central axis of symmetry of the system.

Fig. 4 shows the arrangement of Fig. 3 the beam superposition pattern.

My invention provides for the delineation and clear illumination in an attractive manner of elongated structures and large public buildings in a manner which heretofore has not been obtainable.

Referring to the drawings, Fig. 1 shows an arrangement wherein the lateral reflecting elements which are placed on the left side, for example, of the central reflecting element, project their reflected beams into the right portion of the composite projected beam, and correspondingly, the lateral reflecting elements on the right project their reflected beams into the left portion of the reflected beam. From Fig. 1 it will be seen that the beams reflected by the lateral elements on one side cross the beams reflected by the lateral elements on the other side. The relative positions of the different reflecting elements of the projector may also be selected in such a manner that the rays reflected by the inner edges of the lateral reflecting elements located on one side

of the central reflecting element are parallel to the outer ray projected by the outer edge of the other side of the central reflecting unit. Consequently, the rays projected by the inner edges of the left lateral reflecting elements are parallel to the ray reflected by the right outer edge of the central reflecting element, while the rays reflected by the inner edges of the lateral reflecting elements on the right are parallel to the outer ray reflected by the left outer edge of the central reflecting element. The width of the elements in this case is preferably so selected that the angles m_2, m_4, m_6, m_8, between the rays reflected by their inner edges and the rays reflected by their outer edges, is smaller than the angle m between the extreme rays reflected by the outer edges of the central reflecting element.

By the provision of the reflecting elements as above described, projectors are obtained whose opening is smaller for large values of the inclination of the lateral reflecting element relatively to the central reflecting element, and the reflector 17 (Fig. 1) which may be placed in front of the luminous source F may then embrace an angle less than 180°, for example 120°, which is more advantageous, especially as regards the cooling of the apparatus.

In the form of the invention shown in Fig. 1, the projector consists of a central element 1, four lateral reflecting elements 3, 5, 7, 9, provided on the right side of the plane of symmetry Y—Y passing perpendicularly through the central point of central reflecting element 1, that is, perpendicular to the plane of the drawing, and four outer lateral reflecting elements 2, 4, 6, 8, provided on the left side of the plane of symmetry Y—Y.

All of these reflecting elements have the same width e and further have the same height. These reflecting elements are of substantially rectangular shape, that is, when they are developed and placed flat on a plane, each reflecting element has substantially rectangular shape, which permits of easily cutting out or stamping the individual reflecting elements as metal sheets. Before mounting in the reflector, the elements are formed to be curved concavely in a single direction lengthwise of the element, according to a curve which is a conic section, such as an ellipse, parabola, or hyperbola, the apex or vertex of which curve is located in the transverse plane of symmetry of the system, that is, the plane of the drawing.

The trace of each element on this transverse plane of symmetry or plane of the drawing is a straight line. These traces of adjacent elements form a continuous chain.

A parabolic longitudinal curvature of the element is selected if a thin or narrow reflected beam of small spread is desired, and an elliptic or hyperbolic curvature is selected when a wide angle beam is desired. All of the reflecting elements of a given projector have a longitudinal curvature of the same type, such as all being parabolic, or all being elliptical. The focal distance of the curve according to which a given element is to be curved concavely is determined separately for each element. Two individual reflecting elements which are symmetrically placed relatively to the central plane of symmetry Y—Y, have the same focal distance.

Since the vertex of the conic section curve according to which a given reflecting element is curved concavely is located in the transverse plane of symmetry, that is the plane of the drawing, the focal distance of said curve is given by the focal distance of the reflecting element itself, that is by the distance separating the source from a plane perpendicular to said transverse plane of symmetry, and passing through the trace of the considered reflected element upon said transverse plane of symmetry. Therefore this focal distance for a given reflecting element is represented by the length of the projected perpendicular from the source on the extended transverse trace of a given reflecting element on the plane of the drawing.

Thus, for example, the focal distance of lateral reflecting element 9 is the length of the line 95, which is the perpendicular dropped from source F on the extension 94 of element 9, and this element 9 is curved concavely according to the conic section curve which has this focal distance shown as the length 95.

It follows that the transverse sections of each of the various reflecting elements, taken on any plane parallel to the plane of the drawing, are straight lines.

In constructing the apparatus there is first selected the width e which is the same for all the reflecting elements of the arrangement shown in Fig. 1, and then only the angular positions of the reflecting elements relative to the central reflecting element remain to be determined. This angular position is graphically successively determined for each element by making the angle of reflection equal to the angle of incidence for the rays incident on the edge of each element.

The various reflecting elements are each placed on a movable support. Each support is mounted on a frame, and its position is adjusted at the factory. If necessary, the geometrical position of each element may be changed to a certain extent, so as to obtain a slightly different light distribution.

There may be first determined the focal distance 15 of the central reflecting element 1 so that its extreme edges send the outer rays 11 and 12 back in the desired directions. The focal point F and focal distance 15 are determined if spread angle m between extreme rays 11 and 12, and the width e has been selected, since with reference to the perpendicular erected at the end of central element 1, angle of incidence a must equal angle of reflection b. In Fig. 1, a spread angle of 60° between the ray paths 11 and 12 has been selected. This spread angle m cannot be so wide that its outer rays intercept the outermost lateral reflectors. This spread angle m gives one of the dimensions of the beam, thus, it is determined by one of the dimensions of the surface to be illuminated, and by this distance at which the projector is placed therefrom.

If the spread angle m is first selected, there are then drawn the outer rays 11 and 12 reflected by the extreme outer edges of central reflecting element 1.

Lateral reflecting element 3 is then placed at such an angle that the inner reflected ray 32, which is reflected by its inner edge, will be parallel to the extreme ray 12 reflected by the extreme left edge of central element 1. It will be found that for a spread angle m of 60°, which is convenient, this element 3 must be placed perpendicularly relative to this ray 32. Thereupon the selected width e of the reflecting element is laid off. There is then constructed the ray 33 reflected by the outer edge of element 3, and for this purpose the perpendicular is erected on the extreme end of element 3, and the angle of re-

flection f' is made equal to the angle of incidence f which determines the direction of this extreme ray **33**. Inasmuch as reflecting element **3** is perpendicular to beam **32**, the perpendicular constructed on the extreme outer end of element **3** is parallel to beam **32**, and therefore coincides with ray **52** which is reflected by the inner edge of reflecting element **5**. The reflecting element **5** must therefore be perpendicular to the bisector g of the angle of incidence f. The width e is then laid off and the perpendicular is erected on its extreme end, and the angle of reflection i' is made equal to the angle of incidence i, in order to obtain the direction of the extreme ray **53** reflected by the outer edge of element **5**. Then extreme inner ray **72** is drawn parallel to ray **52**, and reflecting element **7** is laid off perpendicular to the bisector of the angle of incidence i.

The same construction is repeated for each reflecting element. The number of reflecting elements is limited by the spread between rays **11** and **12**, which are the extreme rays reflected by the central reflecting element. These extreme rays **11** and **12** must be permitted to radiate freely, and must not be intercepted by any part of the outermost lateral reflecting elements.

Fig. 2 shows diagrammatically the superposition of the individual beams reflected by the different individual reflecting elements, on an extended surface illuminated by the projector, as would exist at a considerable distance.

Assuming that the beam of the central element **1** illuminates a surface of a width j corresponding to the spread angle m between the outer rays **11** and **12**, reflected by this central element **1**, then it will be seen from Fig. 1 that on opposite sides of the central plane of symmetry of area j, the lateral reflecting elements **2**, **4**, **6**, **8**, superpose their reflected beams on areas u, h', h'' and z and the lateral reflecting elements **3**, **5**, **7**, **9**, on the areas k, l, h, i', each corresponding with the angle between the inner and outer rays reflected by these elements respectively.

It will be seen that by means of the projector which I provide it is possible to employ five reflecting elements to illuminate the outer end of the structure to be illuminated, whereas the intermediate parts of the structure are illuminated by only four elements, and the exact center by only three reflecting elements.

It follows that if the illumination produced on the center of the illuminated surface is equal to 3 units, the illumination of the extreme ends of the surface is equal to 5 units, inasmuch as the spread angles of the light fluxes r, s, t, v, w, incident upon reflecting elements **1**, **3**, **5**, **7**, **9**, are approximately proportional to the widths j, k, l, h, i'', of the surface illuminated by each of them, and all of the reflecting elements are of the same length and illuminate a surface of equal height.

This type of projector shown in Fig. 1 is particularly adaptable for illuminating buildings presenting complicated and intricate architectural designs, for which it is necessary generally to throw more light on the extreme ends of the structure, in order to give the whole a better relief.

For certain purposes it is preferable to use a modified form of my invention as shown in Fig. 3, wherein the central reflecting element **101** illuminates the entire surface to be illuminated, while the beam projected by each lateral reflecting element extends only over one-half of the surface to be illuminated. This projector gives even illumination of the entire surface, and is preferably employed to illuminate buildings embodying modern architectural styles of simple lines.

Such a projector is shown in transverse section in Fig. 3. The extreme inner rays **132**, **152**, **172**, and **121**, **141**, **161**, are made respectively parallel to the extreme outer rays **111** and **112** reflected by the outer edges of central reflecting element **101**. The extreme outer ray **130**, **150**, **170**, and **129**, **140**, **160**, reflected by the outer edges of the lateral reflecting elements, are all made parallel to the central plane of symmetry Y—Y passing through the central point of central element **101** perpendicularly thereto and perpendicularly to the plane of the drawing. These two conditions being laid down, the widths of the individual reflecting elements on a given side of the central reflecting element in general will not be the same and must be determined graphically as determined by the condition that the angle of reflection equals the angle of incidence.

For the arrangement of Fig. 3, the angular position of lateral reflecting element **103** is determined in a manner similar to what has been explained above for Fig. 1. The spread angle n between extreme rays **111** and **112** reflected by the edges of central element **101** is again desirably selected as 60°, and element **103** is therefore perpendicular to ray **132** which is the extreme ray reflected by the inner edge of element **103** and which is parallel to ray **112**. The outer edge of element **103** reflects an extreme ray **130** which is parallel to the plane of symmetry Y—Y passing through central element **101**. In this arrangement shown in Fig. 3, it is not ordinarily possible to have all of the reflecting elements of the same width, as in the arrangement of Fig. 1. The width of the lateral reflecting element **103** is determined by the intersection of the line giving the angular position of element **103**, which is perpendicular to ray **132**, with the incident ray **156** coming from the source F, which is reflected according to outer ray **130** parallel to the plane of symmetry Y—Y. The direction of said ray **155** coming from the source F is found by making angle of reflection p' formed by outer ray **130** with the perpendicular to element **105** equal to the angle of incidence p formed by said perpendicular with said ray **155** coming from the source.

Then the extreme inner ray **152** is drawn which is reflected by the inner edge of element **105**, parallel to rays **132** and **112**. The normal to the bisector of the angle q between the line of the ray **153** from source F, and inner extreme ray **152**, gives the angular position of the reflecting element **105**. The width of this lateral reflecting element **105** is determined in the same manner as the width of lateral reflecting element **103**. The same procedure is successively followed for each element, it being understood that the lateral reflecting elements **102**, **104**, **106**, and **103**, **105**, **107**, provided symmetrically relatively to the plane of symmetry Y—Y, are necessarily and respectively of the same length or height, and in the corresponding angular positions.

The lateral reflecting elements of Fig. 3 are concavely curved in a single direction longitudinally as described for the embodiment of Fig. 1, according to conic section curves, whose focal distance is determined in the same manner.

In my copending application Ser. No. 178,789 filed Dec. 8, 1937, now Patent No. 2,255,819, I have shown in Fig. 7 thereof a reflecting system for illuminating elongated structures, but the structure therein described is decidedly more

cumbersome and produces less illuminating efficiency than the arrangement which I have here shown in Fig. 3. In the arrangement here shown, because of the fact that the ray reflected from one side crosses the plane of symmetry to the other side, the lateral reflecting elements are inclined to a larger degree, with the result that the dimensions of the projector are much smaller, and that a smaller number of reflecting elements is required, notwithstanding which a larger spread angle of light flux is produced, which produces a better utilization of the light source.

The construction of the reflecting systems according to the above description presents considerable advantages, because, by selecting the dimensions, orientation, and curvature, of the elements properly, beams are obtained which are of rectangular or square cross section and have well defined clearly marked boundaries. Thus, by means of such a projector it is possible to illuminate objects or structures in the middle of a city by adjusting or setting the limits of the reflected light beam in such a manner that only the object desired is illuminated, whereas immediately adjoining objects remain in deep shadow or darkness.

An application of the principle and apparatus which has been here described has been made in illuminating a tower in the middle of a river. For many years, the city of Lucerne, Switzerland, sought to illuminate this tower, but there did not exist any apparatus which could satisfactorily accomplish the desired result, because the apparatus which it was attempted to use produced a seriously dazzling effect on the guests in hotels along the river banks. It was only after the projectors herein described were employed, that it was found possible to intensely illuminate the tower in the desired manner, and at the same time leave the buildings which stand along the river bank in deep shadow or in darkness.

In employing the invention which I have described, it will be understood that depending on the size of the object or structure to be illuminated, optical elements and systems of suitable characteristics and dimensions are constructed. For example, the spread angle *m* between extreme rays 11 and 12 reflected from the edge of the central reflecting elements, instead of being 60°, may be 15°, 30°, 40°, etc. Moreover, the height of the object or structure to be illuminated determines the spread angle α of the beam in the other direction, perpendicular to the plane of the drawing. For a very low object, elements curved according to a parabola are employed. If the object is somewhat higher, it may be found preferable to employ elements which curve according to an ellipse. The geometrical constants or parameters of this ellipse are determined by the height of the reflecting element, which height is the same for all the reflecting elements and which is arbitrarily chosen, and is further determined by the spread angle α of the beam which is required by the height of the object to be illuminated and by the respective focal distances of each element.

According to the present invention, all elements are of the same height and of substantially rectangular shape, resulting in minimum waste of the raw material for constructing the reflecting elements, and they are juxtaposed beside each other. But since each reflecting element is curved concavely along the direction of its length according to a curve having as its focal distance the focal distance of the reflecting element considered relatively to the source, and since the focal distance increases with larger values of the spacing of the lateral reflecting elements from the central reflecting element, it follows that the ends of the inner edges of an outwardly positioned lateral element overlie the ends of the outer edges of a lateral reflecting element lying adjacent on the side toward the central reflecting element. Thus, even after the projector has been assembled, the adjusting of each individual lateral reflecting element can still be changed to a certain extent to suit conditions and requirements.

The projector which I have described radiates a beam whose transverse section is of substantially rectangular shape, and the boundary of the illuminated field has rigorously straight lines on all four sides. In this way, it permits solution of the problem of illuminating objects, such as monuments, located in the middle of a city, which cannot be accomplished by any other projector now known.

ETTORE SALANI.

PUBLISHED
MAY 25, 1943.
BY A. P. C.

E. SALANI
PROJECTORS
Filed March 4, 1942

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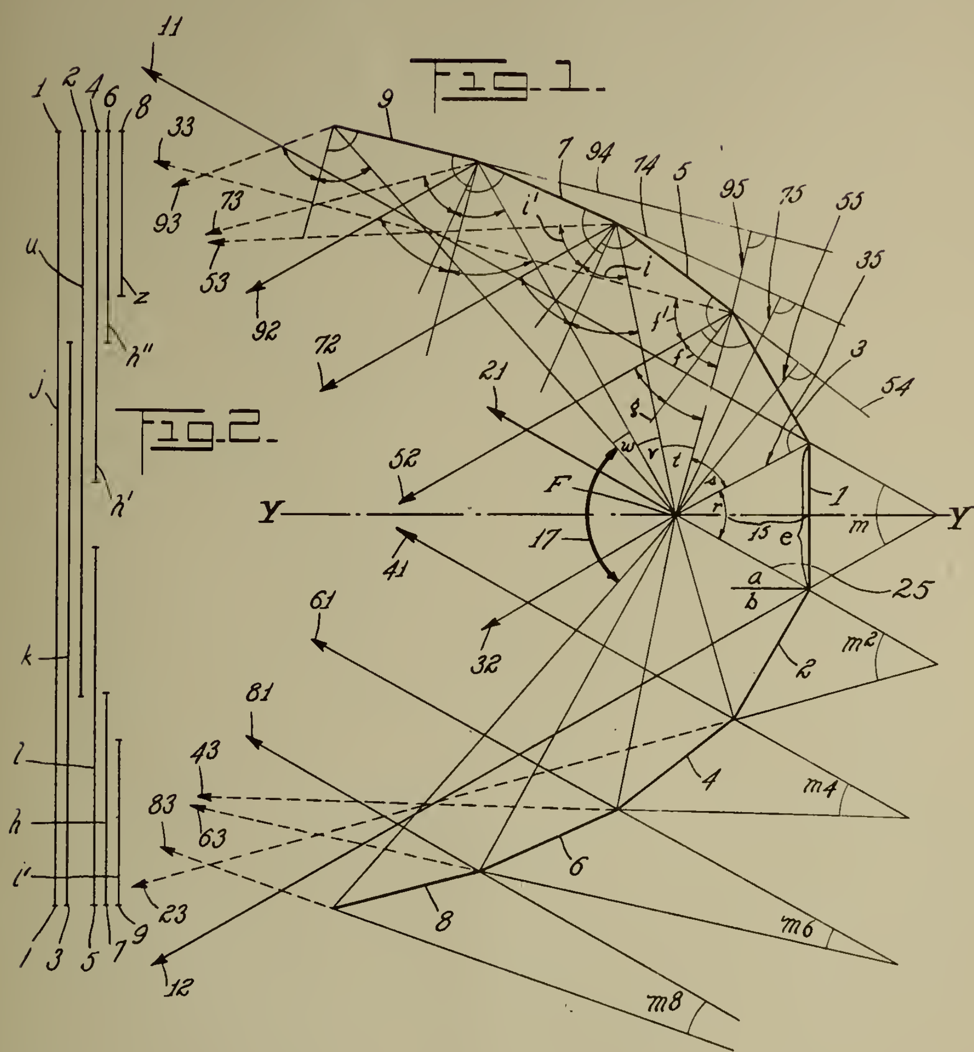
2 Sheets-Sheet 1



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2 Sheets-Sheet 2

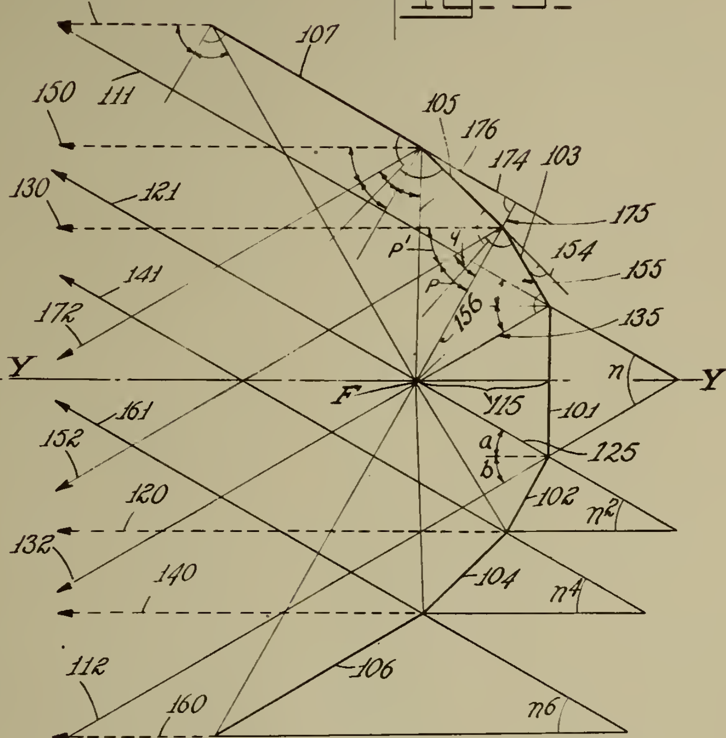

Fig-3-

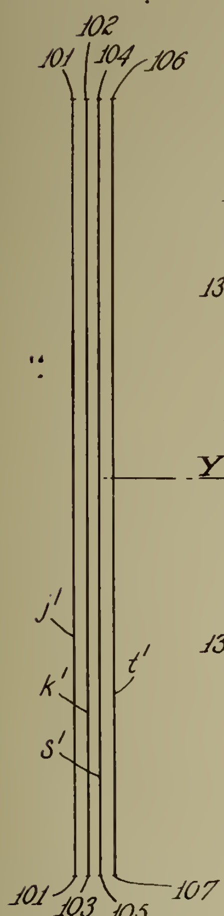

Fig-4-

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Published May 25, 1943 Serial No. 434,620

ALIEN PROPERTY CUSTODIAN

CLEANING COMPOSITIONS IN PASTE-FORM

Hermann Rudy, Mannheim and Gustav Warnecke, Ludwigshafen-on-the-Rhine, Germany; vested in the Alien Property Custodian

No Drawing. Application filed March 13, 1942

This invention relates in general to cleaning compositions in paste-form and their method of production, and in particular to the process of incorporating these products into soap or soap-like compounds.

The alkali metal-, ammonium- and organic ammonium salts of phosphoric acids having a lower proportion of water molecules than orthophosphoric acid are known for their capacity of linking metal ions into complex state and thereby keeping in solution the salts of the alkaline earths in water, even in presence of specific precipitating agents. Therefore, they are extensively applied in various textile and washing processes, where they are added in powdered form to the aqueous liquor. For the same purposes are also suitable the nitrogen-phosphoric acid compounds obtained either by reacting gaseous ammonia with solid P_2O_5 or by heating urea and nitrogeneous compounds, such as acid amides, nitriles, derivatives of carbamic acids or hexamethylene tetramine, with any phosphoric acid.

Furthermore, the washing power and the activating effect which these phosphates have on other washing agents have already been pointed out, for which reason they are frequently mixed with other washing agents and especially incorporated into soap, the added amount of phosphates being relatively small. As far as these washing agents are intended to clean the hands—in which case they cannot be employed for example in form of a mixed powder of any composition—they can only be prepared with a relatively small addition of phosphates. Thus it is technically impossible in the manufacture of solid soaps used for the cleaning of the hands to exceed an addition of 20% of phosphate, because otherwise the soap mass does not only lose its homogeneousness (homogeneity), but — in consequence of the high electrolytic properties of the phosphoric salts—also its lathering power. For this reason the specific cleaning capacity of the phosphates could not be completely utilized for cosmetic purposes.

Now the surprising discovery has been made that the water-soluble salts of phosphoric acids having a lower proportion of water molecules than orthophosphoric acid as well as the products obtained by reacting ammonia with P_2O_5 or by heating any phosphoric acid with an organic nitrogen compound, such as urea, acid amides, nitriles, derivates of carbamic acid, hexamethylene, can be transformed by addition of a small amount of a dispersive-, emulsifying-, or washing-agent and a little water into pastes, in which form they are especially suitable for cosmetic purposes. The specific and surprising action of this composition becomes evident for example in cleaning one's hands from oily substances or fruit- and vegetable-juices. While at the use of normal washing liquors or those containing a small amount of phosphates having a low proportion of water molecules the colourings caused by fruits or vegetables and deeply penetrated into the skin can only be removed by long washing, the desired effect is obtained with the products according to the present invention within a short time.

As emulsifying- or dispersive-agents for the conversion of the mentioned phosphates into paste-form are suitable in first line the colloidal organic washing agents of high molecular weight, such as soap, i. e. the alkali metal salts of fatty acids of higher molecular weight, sulphuric acid esters, as well as pure sulphonic acids of fats, oils, waxes, and fatty alcohols, products of condensation from fatty acids of higher molecular weight with oxyalkyl sulphonic acids, such as oleyl oxyethane sulphonic acid sodium, oleylmethylaminoethyl sulphonic acid sodium, proteins of high molecular weight, polyglycol ethers of aromatic and hydro aromatic hydroxyl compounds which are substituted in the nucleus by at least one hydro carbon or alkyl radical containing at least 4 carbon atoms, and the like. But also starch, cellulose ethers, pectins, kaolin, bentonite, as well as synthetic substances easily swelling or colloidal-soluble in water, such as polyvinyl alcohol, may be employed. Thus the mixture can be adjusted either alkaline or neutral or acid according to requirement. For the cleaning of very oily objects it is recommendable to add to the paste fat-dissolving agents.

By "small amounts" of an emulsifying or dispersive agent in the sense of the present invention are understood about 10%, calculated on the phosphate.

The pastes according to the present invention can also be manufactured to solid, moulded washing agents. Up to now just the incorporation of phosphates into washing agents, especially into the soap mass, met with some difficulties. There is, for instance, a disadvantage in the manufacture of phosphate-containing soaps from highly dried soap chips as they are used in the production of toilet soaps and soap flakes owing to the phosphate solution frequently not being uniformly absorbed by the soap. The result is a crevassed, stained and mean-looking soap. Up to now it was therefore necessary to keep the phosphate additions within narrow limits and to mix them very thoroughly and carefully with the soap mass.

Another difficulty in the manufacture of soap with anhydrous phosphates still encountered is that through adding a slightly alkaline phosphate solution to soap, the pH-value of the mixed product sinks down into the acid range, thus leading to rancidity of the soap.

Finally, it always seemed detrimental to the

manufacturers of washing agents that the added phosphates dissolve but very slowly and with difficulty in small quantities of water. The consequence was either that the incorporation of phosphates was omitted or that undissolved phosphate parts or crystals came into the soap mass.

These disadvantages can, however, be easily avoided if the phosphates having a low proportion of water molecules or the nitrogen-phosphoric acid compounds are incorporated in form of the above-mentioned paste. The process is carried out as follows: To a highly concentrated phosphate solution are added under stirring about 10% of a hot aqueous soap solution. The paste now forming contrary to the soap-phosphate mixtures used up to now can be designed as a soap in phosphate solution. This paste can be thoroughly mixed with any dry soap mass by which it is absorbed completely and homogeneously. The mixture adjusted to the desired pH-value, remains constant at the following incorporation into the chief soap mass.

Example 1.—18 kg of sodium hexametaphosphate are dissolved in 18 litres of water to which solution are added under intense stirring

	Kilograms
Swelled starch	1,5
Sodium silicate with 5 molecules of water of crystallization	0,8
Caustic soda lye of 38° Bé	0,3
Titanic white	0,1

Example 2.—To a highly concentrated aqueous solution of 10 kg of sodium tripolyphosphate are added 1 kg of soap and 0,3 kg of caustic soda lye; this mass is stirred in a mixing apparatus (vessel) until a homogeneous paste is obtained.

Example 3.—20 parts of a nitrogen-phosphoric acid compound obtained by heating beyond 140° 80 parts of metaphosphoric acid with 60 parts of urea are dissolved in a little water and mixed with 3 parts of the sodium salt of an acid ester of sulphuric acid of the oleic alcohol to a homogeneous paste.

Example 4.—10 parts of sodium pyrophosphate, dissolved in water, are stirred with 0,5 part of sodium metasilicate, 0,2 part of caustic soda lye of 40° Bé, 5 parts of cyclohexanol and 1 part of isooctyl phenyl tetra glycol ether until a homogeneous mass is obtained.

Example 5.—9 parts of sodium hexametaphosphate are dissolved under stirring in 9 parts of water and then adjusted by means of concentrated caustic soda lye to a pH-value of about 10. This solution is mixed with 2 parts of a 50%, warm solution of soda soap and 0,4 part of anhydrous sodium metasilicate and thoroughly kneaded in a kneading machine. The pH-value is then about 10. This mass can be worked without difficulties as well with the soap paste (glue) as with highly dried soap chips, resulting after short mixing a homogeneous soap mass.

HERMANN RUDY.
GUSTAV WARNECKE.

Published May 25, 1943

Serial No. 435,196

ALIEN PROPERTY CUSTODIAN

HAND PIECES OR HOLDING DEVICES FOR ROTARY TOOLS AS USED BY DENTISTS

Claude Etienne Garnier, Besancon, France; vested in the Alien Property Custodian

Application filed March 18, 1942

The present invention relates to the hand pieces or holding devices for rotary tools as used by dentists.

These devices include, inside a fixed outer body or sleeve, a socket rotating together with the driving axis or shaft and, inside this socket, a jaw-holder in which is mounted the end of the tools or other small instruments of this kind which are to be caused to rotate. These instruments are fixed to the rotating axis or shaft by tightening the grasp of the jaw-holder, this tightening being obtained by longitudinally pushing said jaw-holder toward the end of the socket in which it is housed, whereby, in the course of this longitudinal displacement, the end of the jaw-holder engages in a cone formed inside the socket so as to bring the jaws toward each other and tightly to grasp the instrument between said jaws.

Up to the present time, this longitudinal displacement of the jaw-holder has been obtained through the sliding displacement of an inner inclined surface which pushes said holder in either of the two following manners:

(*a*) Through a small lever contained in the socket in which the jaw-holder is housed; or

(*b*) Through the action of two balls, also contained in this socket, and which are forced radially, by the sliding motion of an inclined surface of the rotating axis or shaft, between two circular conical cups, one of which bears against one end of the jaw-holder, while the other one is fixed to the rear end of the socket; this radial movement of the balls thus causes said conical cups to be moved away from each other in the longitudinal direction and therefore produces the desired longitudinal displacement of the jaw-holder.

Both of these devices involve serious disadvantages:

The device including a small lever is very difficult to manufacture and it is very complicated to be taken to pieces.

In the device including balls, said balls, which are necessarily very hard, contact the surfaces of the cups with which they are to cooperate only at one point, so that, after a certain time, they project into the surface of said cups and deform them. Furthermore, as these cups are of circular cross-section, it is necessary to keep the balls in opposed diametral relation to each other, at least when assembling the parts, by means of a cage which is necessarily rather weak. Finally, as the rotation of the tool or instrument is imparted through the central axis or shaft which carries the inclined surface serving to force the balls radially, the drive of the socket is obtained only through the wedging of these balls.

The object of the present invention is to provide a device which avoids the above mentioned drawbacks.

According to a feature of the present invention, the longitudinal displacement of the jaw-holder, in order to tighten the jaws thereof on the tool, is obtained by radially forcing wedges of suitable shape between two sleeves arranged substantially as the cups above referred to, but provided on their adjacent ends with oblique surfaces constituting both housings and friction surfaces for said wedges. The wedges are provided on the one hand with a flat face which bears against the oblique face of the inclined surface carried by the rotating axis or shaft, and, on the other hand, two faces, which are also flat, cooperating with the oblique surfaces of the sleeves.

With such a device, a longitudinal sliding of the inclined surface causes the wedges to move outwardly and this outward motion produces, through the cooperation of the oblique surfaces of the wedges and of the sleeves respectively, the desired relative longitudinal displacement of the jaw-holder and of the socket.

In order to keep the wedges in connect working position, I may provide a special shape of the surfaces which laterally limit the friction surfaces of the sleeves. I may also make these wedges of a special shape so that they partly surround the piece carrying the inclined surface or I combine both of these features.

With such a wedging system, as the contacting surfaces are of relatively large area, no deformation can occur and as the wedges are necessarily kept in proper position, they constitute keys for transmitting the rotary motion of the shaft to the socket.

Other features of the present invention will result from the following detailed description of some specific embodiments thereof.

Preferred embodiments of the present invention will be hereinafter described, with reference to the accompanying drawing, given merely by way of example and in which:

Fig. 1 is a longitudinal section of the front part of the tcol holding device according to the invention;

Fig. 2 is a cross-sectional view on the line II—II of Fig. 1;

Fig. 3 is a partial view analogous to Fig. 1, showing another embodiment of the device according to the invention;

Fig. 4 is a cross-sectional view on the line IV—IV of Fig. 3;

Fig. 5 is a part sectional view analogous to Figs. 1 and 3, and showing a third embodiment of the invention; the central piece which carries the inclined control surface being not shown in this view;

Fig. 6 is a cross-sectional view on the line VI—VI of Fig. 5;

Fig. 7 is a longitudinal sectional view analogous to Fig. 5 and corresponding to a modification;

Fig. 8 is a cross-sectional view on the line VIII—VIII of Fig. 7.

The tool holding device shown by the drawings (Figs. 1 and 2) includes, in the usual manner, an external body **1** in which a socket **2** is adapted to turn. A jaw-holder **3** is housed inside this socket **2**. The tightening of said holder **3**, for fixation of the tool to the end thereof, is obtained by pushing said holder outwardly in the longitudinal direction inside socket **2**.

At the rear end, jaw-holder **3** is mounted in a piece **4** which bears, through piece **5** and adjustment rings **6**, against a sleeve **7**, which constitutes one of the two sleeves above mentioned. The other sleeve, designated by reference numeral **8**, is fixed to the rear end of socket **2** by means of screw threads. This sleeve further bears against the usual piece **9** inside which the axis or shaft **10**, which transmits the rotating motion, is journalled. This axis or shaft **10** carries the double inclined surface **11**, of small inclination, which is to cooperate, with wedges **12** as above explained. This portion **11** of shaft **10** extends through the bores of sleeves **7** and **8**.

Wedges **12** are mounted on either side of piece **11**. They bear against the inclined surface of this piece through their respective faces **12***a*. They cooperate laterally with the walls of notches **7***a* and **8***a* provided in the ends of sleeves **7** and **8** respectively, so that the rotating movement of wedges **12**, imparted thereto by piece **11**, is transmitted to these sleeves **7** and **8**. Sleeves **7** and **8** are further provided with oblique faces adapted to cooperate with corresponding oblique faces of wedges **12**. It will be readily understood that these wedges are thus always kept in the correct position shown by the drawing.

It will also be clear that the apparatus can be taken to pieces by merely unscrewing sleeve **8**, and that the reassembling of the parts is very simple owing to the fact that the wedges can readily be engaged into their housings.

When piece **11** is pulled with respect to the outer body **1**, the inclined surfaces of said piece **11** act against wedges **12**, between which it slides, whereby said wedges are forced outwardly between sleeves **7** and **8**. As sleeve **8** is fixed to socket **2** and the latter bears against piece **9**, this outward movement of the wedges necessarily produces the sliding displacement of sleeve **7**, piece **4** and jaw-holder **3**; the latter is therefore wedged into the conical housing provided at the end of socket **2**, and caused tightly to hold the tooth inserted between its jaws.

Of course, I can vary the number and shape of the wedges and also the dihedral angles of the oblique parts without departing from the spirit of the invention.

In the example of Figs. 3 and 4, the friction surfaces **7***b* and **8***b* of the sleeves are constituted by conical surfaces and the wedges are provided with surface elements of the same shape adapted to cooperate therewith. In this case, these wedges are kept in position along piece **11** by the fact that they include extension portions **12***b* through which they partly envelope piece **11**.

The embodiment illustrated by Figs. 5 and 6 is analogous to that of Figs. 3 and 4, with however the difference that friction surfaces **7***b* and **8***b*, instead of being of conical shape, are flat shaped, forming two dihedral angles disposed opposite each other and between which the wedges are housed.

Finally, in the embodiment of Figs. 7 and 8, the sleeves are provided with analogous flat friction surfaces, but the wedges do not envelope piece **11**. In this case, they are kept in position by two projections **7***c* and **8***c*, diametrally opposed to each other.

It should be noted that, according to the present invention, the oblique or conical friction surfaces may be replaced on one of the sleeves, and the corresponding side of the wedges, by a mere perpendicular abutment.

CLAUDE ETIENNE GARNIER.

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MAY 25, 1943.

BY A. P. C.

C. E. GARNIER
HAND PIECES OR HOLDING DEVICES FOR
ROTARY TOOLS AS USED BY DENTISTS
Filed March 18, 1942

Serial No.
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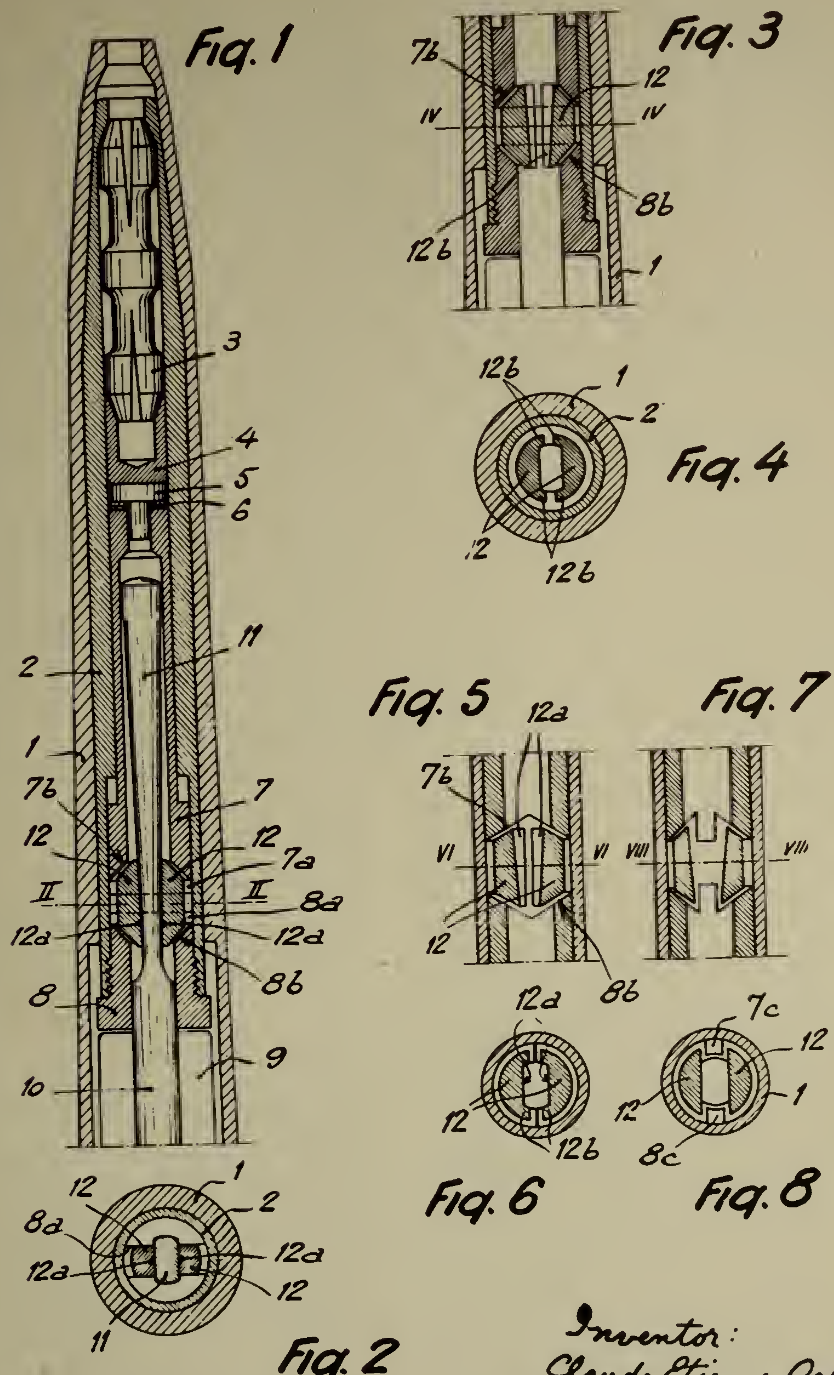

Inventor:
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By Sager & Malcolm
Attorneys

Published May 25, 1943

Serial No. 436,532

ALIEN PROPERTY CUSTODIAN

BOTTLECLOSURE OF THE CROWN-CORK TYPE AND SEALING DISC FOR THE SAME

Friedrich Ottenstein, Copenhagen, Denmark; vested in the Alien Property Custodian

Application filed March 27, 1942

In the manufacture of bottle closures of the crown-cork type sealing discs of cork or cellulose in a "worked" state such as card board has been used.

The principal object of the present invention is, as a substitute for cork to employ a special kind of cellulose material one surface of which, according to a further feature of the invention is corrugated.

A further object of the invention is to secure the highest elasticity at the required points of the sealing disc and for this purpose the use of two or more discs, the dimensioning of the discs and the pasting together of the same at special points are further features of the invention.

The cellulose material employed i. e. pulpboard without the addition of glue or filling materials, usually used in paper making, does not in the same degree as cork possess the plastic and elastic properties, which are characteristic for this material, and it is therefore also, as it will appear from the above, an object of the invention to draw advantage from the natural qualities of the pulp-board, these being tenacity and toughness combined with some degree of elasticity; and employ the special shaping of the surface of the pulp obtained during the rolling or pressing of the same when dried and which consists in little indentations so as to secure a maximum of elasticity.

These small indentations, which are only found on one side of the disc, have in no way influence on the structure of the mass, as they are formed during the composition of the same and are therefore quite different to indentations made by special tools in paper board, which is hardened by glue and filling materials, so that such indentures will considerably weaken the structure.

Cellulose material of the kind dealt with will for the same reason be very cheap in use, as it does not require any special treatment apart from the one it has already been subject to during its drying, rolling or pressing.

When the sealing disc is placed in the part of the bottle closure consisting of the usual outer metal crown, the corrugated side of the disc is turned inward towards the metal so as to give way in points when pressure is applied to it.

The other side of the disc has a comparatively smooth surface, so that in manner known per se it may be covered with a protective layer of high flexibility such as "cellophane," with or without a further protective layer consisting of a central aluminium spot.

According to the invention two or more layers of the above mentioned material may be employed, but in that case the corrugated surfaces are turned against each other whereby a sufficient degree of elasticity is obtained.

When using the preferable form of combining two layers of cellulose material in the sealing disc it is important for the further handling of the layer when placing the same in the metal crown and pressing the latter on to the bottle and also for the purpose of obtaining the proper degree of elasticity that the corrugations on the insides of the layers take up a fixed position adjacent to each other, so that they are not displaced in relation to each other. The position of the little indentations over the surface of each layer is not exactly uniform, and the position of the indentations in relation to each other is therefore adlibitive. It is, however, of importance that the relative position is kept constant. The layers or discs may therefore be glued together, so that the points, which have contact with each other, remain so and so that on the other hand around these points areas will be found where there is no contact and where, when the sealing disc in its entirety is subjected to high pressure, will give way and thereby increase the elasticity of the disc considerably.

It has appeared to be of the greatest advantage to choose the diameter of one of the discs forming the complete sealing disc somewhat smaller than that of the other and in a sealing disc of this nature to glue only the central parts of the layers forming the disc together.

In order to illustrate this feature more fully the drawing shows in Fig. 1 a single layer of pulpboard according to the invention, and Fig. 2 shows to an enlarged scale a bottle closure of the crown cork type with a sealing disc consisting of two layers placed therein, one of larger diameter than the other.

By employing a sealing disc of this nature, in which the two layers are only glued together by their central parts, the outer edge of the large layer will lie rigidly against the bend of the outer crown shell, while the entire disc because of the upper layer, which has a diameter of less dimension, may follow the bottom of a metal crown, when it is bent and deformed by the pressure created, when the bottle closure is pressed on to the bottle.

The sealing disc will under these circumstances give way with a certain degree of resiliency. The advantage obtained by gluing the layers together at certain points has been described above, and

this advantage is naturally maintained in the special embodiment dealt with here, but the disadvantage presented due to the fact that the discs, when the adhesive material in the course of time becomes hardened, and the resiliency therefore diminished is avoided as only the outer edges, which should be most active, because they are the parts of the disc, which are subjected to the most pressure are free to slide on each other.

The upper edge of the bottle mouth will not press directly upon the extreme outer edge of the sealing disc, but if one bisects the radius of the same the pressure from the bottle neck will act approximately in the centre of the middle of the outer half of the bisected radius. By letting the pressure act approximately at the edge of the upper layer of less diameter the same will be better adapted to give way and add to the resiliency of the entire sealing disc.

In the drawings **1** is the plane part of the outer metal shell, **2** the edge of the shell, and **3** and **4** the outer and inner layers of the complete sealing disc. As it will be seen from the drawing the outer layer has a circumference, which reaches out to the edge of the crown cork metal shell **2**, while the inner layer **4** is somewhat smaller. If the layer is subjected to pressure acting in the direction of the arrow A the layer will give way and may be bent inwards without meeting any obstacles. Because of the rigidity of the material employed, the entire sealing disc has considerable elastic properties.

FRIEDRICH OTTENSTEIN.

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BY A. P. C.

F. OTTENSTEIN
BOTTLECLOSURE OF THE CROWN-CORK TYPE
AND SEALING DISC FOR THE SAME
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436,532

Fig. 1.

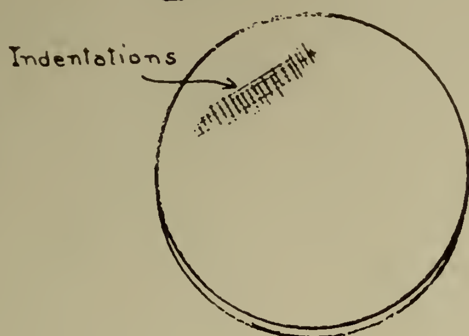
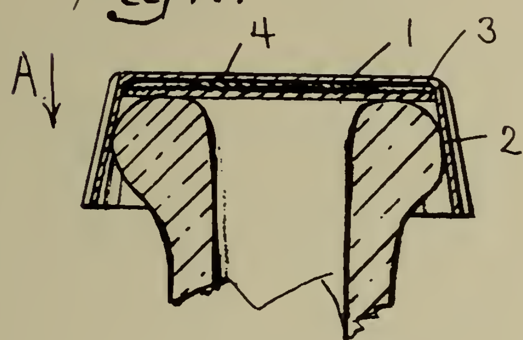


Fig. 2.



Cancelled

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ALIEN PROPERTY CUSTODIAN

MULTIPLE STRAND AERIALS

Pierre Paul Gamet, Paris, France; vested in the Alien Property Custodian

Application filed March 27, 1942

The present invention relates to improvements to multiple strand aerials.

The invention relates more particularly to aerials or aerial systems having a high efficiency and a large aperiodicity for the emission or the reception of radio-electric waves; it is applicable together to reception and to emission aerials and it relates more particularly to the aerials which are used for short and very short waves.

With aerials of this type already used, the experience shows that one can rely on a certain aperiodicity only when the attack of the said aerials is effected in the best conditions of coupling and of adaptation of impedance with the feeding main, which obliges to modify the circuits of adaptation when working with a plurality of wave lengths.

On the other hand, aerials are generally located at inaccessible places (for instance on the top of a mast or of a building) and, in any case, one encounters great difficulties for modifying the aerial box or the feeding main once they are set up. However, it is most desirable to be able to use such a unit in a predetermined range of wave lengths, the aerial retaining in the said range the same properties of radiation and the same characteristic features from the point of view of the emission or reception apparatus with which it is coupled.

The present invention offers this latter advantage without making it necessary, by no means, to modify the mechanical and electrical characteristics of the aerial and of the circuit of adaptation once their are set up and mounted, the said aerial being designed so as to obtain a large aperiodicity the output radiated by this aerial remaining constant in a large range of wave lengths and its optimum operation being such that it does not require a circuit of attack insuring the best conditions of coupling and of adaptation of impedance.

The improved aerial permitting to attain the above mentioned objects shows the characteristic features which result from the following description and more particularly from the appended claims.

Aerials according to the invention are shown by way of examples in the appended drawings, in which:

Figure 1 is a general view of the aerial.

Figure 2 is a plane view of the aerial across the line I—I of Figure 1.

Figure 3 shows a detail of the loop.

Figure 4 shows the spreading out of the loop on a plane.

Figure 5 is a diagram of the elementary aerial.

The aerial is formed of a flat conducing band 1, a second flat conducing band 2 parallel to band 1 and a flat conducing band 3 parallel to band 2 and in line with band 1; these bands 1 and 3, on the one hand, and 2, on the other hand, are spaced from another by a distance which is small with respect to the emitted or received wave length.

The extremities 4 of band 1 and 5 of band 3 are bent for instance to a right angle at 6 and 7 and carry terminals 8 and 9 for securing both wires of the feeding main or the connection wires of the coupling bos.

The bands 1 and 2, on the one hand, and 3 and 2, on the other hand, are connected together by a band 10 and by a band 11 respectively, which are bent in the form of a loop which is such that when spread out on a plane it forms a parabolic surface.

The electrical constant of the aerial depend upon the following dimensions:

L^1 the length of the branch 2 and of the branch 1 with the branch 3, measured on the edges 12, 13 and 14.

L^2 the length of the branches 2 and 1 with 3 measured on the edges 15, 16 and 17.

O^1 the distance between the edges 13 and 14, on the one hand, and 12, on the other hand, of the branches 1, 3 and 2.

O^2 the distance between the edges 16 or 17, on the one hand, and 15, on the other hand, of the branches 1, 3 and 2.

b the thickness of the aerial.

The dimensions L^1, L^2, O^2 and b can vary in large proportions according to the desired range of aperiodicity and the scale of frequencies to be transmitted or received. From this fact, the general form of the aerial can be considerably modified according to the choose of the preceding dimensions.

An aerial of the described type possesses a comparatively low impedance; it is necessary to attack it while passing through the medium of a conventional circuit of adaptation.

This aerial works as follows:

It is comparable to an infinity of aerials joined side by side and strongly coupled together and formed (see Figure 5) of a strand 18, on the one hand, and two strands 19 and 20, on the other hand, of rectilinear form, parallel and separated from another by a distance which is small with respect to the emitted or received wave length. These strands are connected at their extremities by loops 21 and 22.

The length of each of these elementary aerials varies progressively within the limits L^1, L^2; the distance between each of the strands 19 and 20, on the one hand, and 18, on the other hand, varies progressively between O^1 and O^2.

Suppose two points 23, 24 of the wires of the

aerial at the same height X over point 25. The value of the currents I^1 I^2 is given with a first approximation by the following expression:

$$I^1 = A \sin 2\left(\frac{t}{T}+\frac{X}{\lambda}\right)$$

$$I^2 = A \sin 2\left(\frac{t}{T}-\frac{X}{\lambda}\right)$$

where A is a constant, T the period of the oscillations, λ the wave length and t the time.

These equations are true with the sole assumption that the loops do not modify the propagation of the waves and experience confirms this fact.

One sees that both these equations are identical in their form with the sole exception of the sign of the term

$$\frac{X}{\lambda}$$

From the point of view of the field produced at a great distance and since the distance between both strands is small with respect to the wave length, the radiation is identical to that of a single conductor the intensity of which would be the sum of both preceding intensities, which sum has for its expression:

$$I = I^1 + I^2 = 2A \sin 2\pi \cos 2\,\pi\frac{t}{T}$$

One sees that this intensity is homogeneous with that of a dipole tuned on the wave length the intensity of which at the loop of current is equal to twice the intensity in each branch. This calculation shows well the radiation power of this elementary aerial and experience confirms it entirely.

The aerial according to the invention being formed of an infinity of these elementary aerials it has a radiation value which can be considered for a given frequency as the sum of the partial radiations of each elementary aerial while taking into account their mutual inductions.

Experience shows that the radiation resistance of this unit is nearly constant on a large scale of wave lengths and that, on the other hand, its aperiodicity is obtained within large limits even then when the circuit of attack does not correspond to the best conditions of coupling and of adaptation of the impedance.

The invention is of an absolutely general character and can be applied to all the aerials comprising systems of any antennae (radiogoniometers, radiobeacons); it is more particularly advantageous for transmitters with a large traffic scale or for transmitting aerials or reception aerials using large passing bands, in order to obtain the minimum of distorsion (transmission or reception, image in television).

PIERRE PAUL GAMET.

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P. P. GAMET
MULTIPLE STRAND AERIALS
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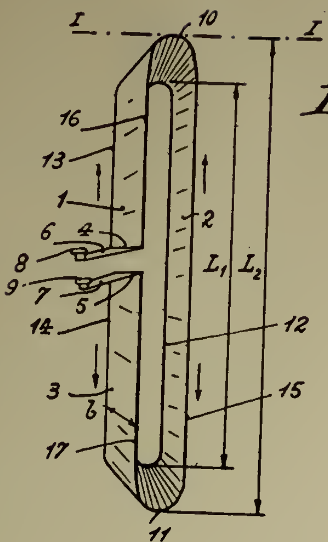
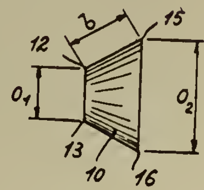


Fig. 1.

Fig. 2.



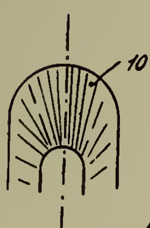


Fig. 3

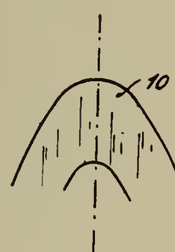
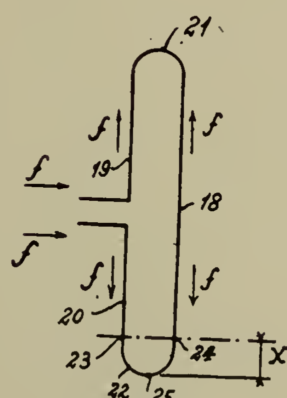


Fig. 4

Fig. 5



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ALIEN PROPERTY CUSTODIAN

APPARATUS FOR RIFLE-PRACTICE

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Application filed April 1, 1942

This invention relates to apparatus for rifle-practice and its primary object is to provide such apparatus, in addition to the direct target, with an indirect target, aim being taken at the direct target and the indirect target serving to ascertain the accuracy of aiming attained in each case.

Another object of the invention is to provide an apparatus allowing to give instruction and acquire practice in shooting at targets without the use of any ammunition, whereby not only ammunition is saved but also the rifles or guns employed with the apparatus will not be subjected to any substantial wear, and the apparatus will be particularly suitable for the instruction of the young which may handle it without any danger of an accident.

Another object of the invention is to facilitate instruction and shorten its term by enabling the instructor to continually follow all movements of the rifle or gun while the pupil is adjusting or leveling the same.

A further object of the invention is to spare the signalizing of hits and the cumbersome method of fault-triangles, all hits being visible on the indirect target.

A still further object of my invention is to provide an effective apparatus for rifle-practice, simple and inexpensive in construction and which will occupy little space in operation so that, also the use of ammunition being eliminated, it will be adapted for indoor use.

With these objects in view, the apparatus comprises, in combination with a support for the rifle or gun movable in all directions on a fixed base and a direct target preferably carried by said base so as to be adjustable in position, a link mechanism carrying an indirect target and forming between the latter and the rifle support such a connection as to communicate all movements of said support to said indirect target, a striker pin pointing at said indirect target and movable in its longitudinal direction in a guide fixed on said base, and a mechanical connection between said striker pin and the trigger of the rifle or gun in the support causing the striker pin to hit upon the indirect target when the trigger is pulled, the said indirect target being so adjusted in position in relation to the striker pin that the line of sight of the rifle or gun in the support and the striker pin will always point at conjugate points on the direct and indirect targets, respectively.

An embodiment of my invention is illustrated, by way of example, in the accompanying drawings in which—

Fig. 1 is a side elevation of the whole apparatus, a rifle placed and fixed on the support being indicated by dash-and-dot lines and the rod **27** carrying the direct target being shown as broken.

Fig. 2 is a top view of the same apparatus with the rod **27** and part of its socket **26** broken away.

Fig. 3 is a section along the line III—III, Fig. 4 is a section along the line IV—IV, and Fig. 5 is a section along the line V—V of Fig. 1, all parts situated outside the link mechanism being omitted.

Fig. 6 is a detail sectional view on a larger scale showing the striker pin in its guide.

In the apparatus, as shown by way of example, the support carrying the rifle G rests on a base-plate **1** and consists of two forks **2** and **3** arranged in alignment at a suitable distance from one another and rigidly connected by means of a slightly cranked rod **4**. Each fork is provided with a winged screw **5** and **6**, respectively, for fixing the rifle in the forks.

Fork **2** is supported by a sort of Cardanic suspension, Figs. 1 and 3, permitting it to move within certain limits in all directions. For this purpose, the fork **2** is provided with two pivot points situated in a horizontal axis a—b and by means of which it is so suspended on a frame **7** as to be rockable about the axis a—b. The frame itself is so mounted in a bracket **8** fixed on the base-plate **1** as to be able to oscillate about a vertical axis c—d in the line of which two pivot points for the frame are fixed, the upper one on said bracket **8** and the lower one on the base-plate **1**.

A downwardly extending projection **9** of fork **3** causes all movements of the support **2**, **3**, **4**, that is to say of the rifle G fixed therein, to be communicated through the intermediary of a Cardanic joint, Figs. 1 and 5, to a rod **10** arranged to form a two-armed lever. This Cardanic joint joint consists of a ring **11** so mounted between two pivot points of the projection **9** as to be able of oscillation about a vertical axis i—k and carrying between two pivot points situated in a horizontal axis l—m a block **12** pivotable about this axis. The rod **10** is introduced with its reduced end **13** into a bore in the block **12**.

The pivot of the two-armed lever formed by rod **10** is situated at A. This pivot, too, is supported by a sort of Cardanic suspension, Figs. 1 and 4, which consists of an external ring **14** fixed on base plate **1** and provided with two pivot points situated in a vertical axis e—f and carrying between them an internal ring **15** so as to be able of oscillations about the axis e—f. Two further

pivot points situated in a horizontal axis $g—h$ are secured within the internal ring **15** to carry between them the pivot **16** of the rod **10**.

The right-hand end of the rod **10** carries a plate or holder **17** on which an exchangeable indirect or auxiliary target **18**, which may be a square sheet of paper, for example, is fixed. It will be apparent from the foregoing that this indirect target will accurately follow all movements of the rifle barrel, designated by L in Fig. 1, in an increased extent depending on the proportion existing between the length of the longer lever arm of the rod **10** and that of the shorter one. As shown in the drawing, by way of example, this proportion is about 10:1 which means that the movements of the rifle barrel L at the point where it is fixed to the fork **3** will be reproduced by the indirect target **18** on a ten times larger scale.

Opposite to the indirect target **18**, a striker pin **20** is so arranged as to be movable in axial direction in a sleeve **22** fixed on the bracket **8**. This pin **20** is guided in the sleeve **22** by a piston **41** at its inner end, and a spring **43** inserted between this piston and a plug **42** tends to retract the pin **20** so far a stop **44** screwed on the pin allows it. In Fig. 6 the pin **20** is shown in this retracted position. Another pin **35** with piston **36** and stop **39** as well as another plug **37** and another spring **38** are provided in a substantially symmetrical arrangement in relation to the analagous parts just mentioned but with the difference that the tension of spring **38** is able to overcome that of spring **43** and a knob **21** is screwed on the free end of pin **35**. This knob serves as a handle to pull the pin **35** outwards so as to allow the nose **34** of a detent **23** to snap, under the action of a spring **33**, through a slot of the sleeve **22** between the pistons **41** and **36** and thus withhold the pin **35** from further inward movement when it is retracted by the tension of spring **38**. The detent **23** is pivotally secured on the bracket **8** at **47** and connected, by means of a Bowden cable **24** suspended on an arm **19** of the support, with a lever **25** located adjacent to the trigger Z of the rifle G so as to be subjected to the action of the trigger. To put a limit to the penetration of the nose **34** into the sleeve **22** in an adjustable manner, at the opposite end of the detent a stop **45** is secured, in a desired position, to the bracket by means of a set screw **46**.

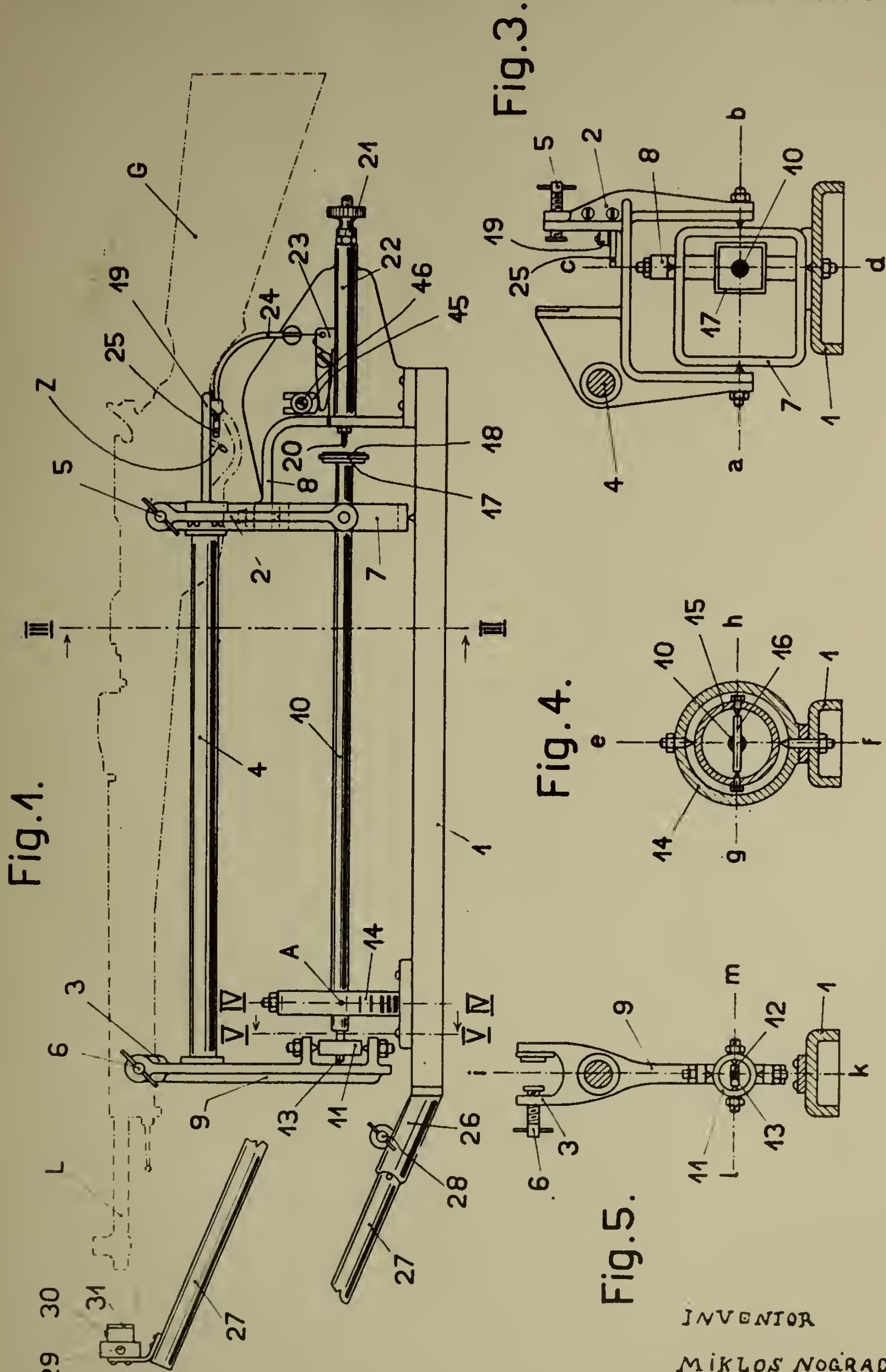
Secured to the opposite end of the base plate **1** is a tube **26** serving as a socket for a rod **27** (shown as broken in Fig. 1) adjustable in longitudinal direction by means of a set screw **28** and carrying at its free end the direct target **31** at which the barrel L of the rifle is to be directed and which is also adjustable in position by means of screws **29** and **30**.

Now, when one, in taking sight, is adjusting the barrel L of the rifle G by means of the movable support to point at the fixed direct target **31**, the indirect target **18** will participate in all movements of the rifle in relation to the fixed striker pin **20**. The apparatus is to be adjusted from the beginning in such a manner that the striker pin **20** should point at such a point or spot of the indirect target **18** as exactly corresponds to that point or spot of the direct target **31** at which the prolonged line of sight is directed. If the rifle is now symbolically fired by pulling the trigger Z, the latter will displace the lever **25** which will, by the intermediary of the Bowden cable **24**, remove the nose **34** from the piston **36** which will, under the action of the spring **38**, instantaneously hit upon the piston **41** and thereby push the striker pin **20** towards and against the indirect target **18**. The mark of impact made by the striker pin on the indirect target **18** indicates the point or spot in which the direct target **31** is pierced through by the prolonged line of sight. Thus the point of impact on the indirect target is characteristic of the accuracy of the aim taken.

The direct target is to be reduced in area in accordance with its reduced distance from the eye of the aimer. The corresponding dimensions of the indirect target can easily be determined from the proportion existing between the arms of the lever **10**.

MIKLÓS NÓGRÁDY.

PUBLISHED	**M. NOGRADY**	**Serial No.**
MAY 25, 1943.	APPARATUS FOR RIFLE-PRACTICE	**437,188**
BY A. P. C.	Filed April 1, 1942	2 Sheets-Sheet 1



INVENTOR
MIKLOS NOGRADY
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PUBLISHED	M. NOGRADY	Serial No.
MAY 25, 1943.	APPARATUS FOR RIFLE-PRACTICE	437,188
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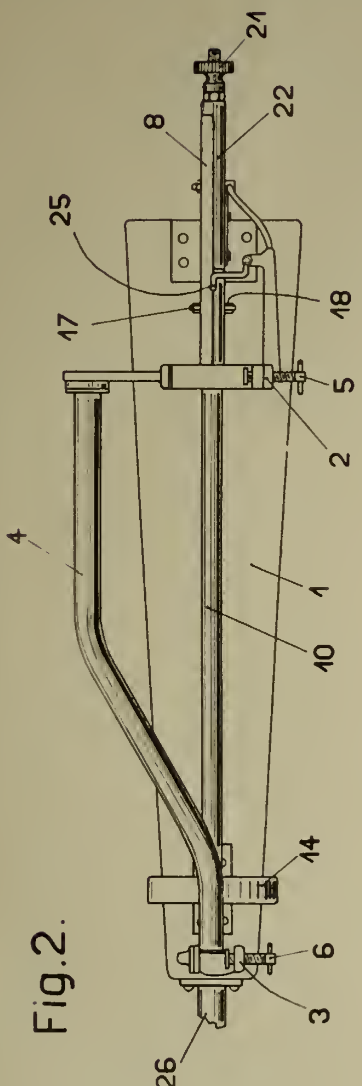

Fig.2.

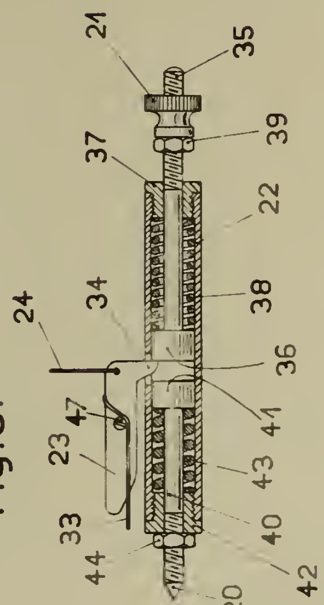

Fig.6.

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ALIEN PROPERTY CUSTODIAN

APPARATUS FOR TAKING FOLDED OR UNFOLDED SHEETS OF PAPER FROM A PILE THEREOF AND CONVEYING THE SAME TO A DEVICE FOR FURTHER TREATMENT

Rudolf Hepp, Berlin, Germany; vested in the Alien Property Custodian

Application filed April 17, 1942

My invention relates to improvements in apparatus for taking folded or unfolded sheets of paper from a pile thereof and conveying the same to a device for further treatment. More particularly my invention relates to apparatus of the type in which the said sheets are successively taken from the bottom side of a pile by means of a conveying device movable below the pile and comprising a roll for taking the sheet from the pile and pile supporting means mounted on the said conveying device.

One of the objects of the improvements is to provide an apparatus of this type in which the bottom side of the pile is exactly held in the proper position relatively to the said rail, and with this object in view my invention consists in providing rigid supporting means on the said conveying device which are movable in such a way that they travel across the bottom side of the sheet substantially with friction, the said supporting means being moved in a direction opposite to the direction of the progressive movement of the said conveying device and substantially at the same velocity as the said conveying device.

In a preferred embodiment of the invention the said supporting means are in the form of a set or sets of rollers located one beside the other and adapted to be rotated during the movement of the conveying device substantially at the velocity of the said progressive movement of the conveying device and in a direction opposite to the said movement of the conveying device.

Another object of the improvements is to provide an apparatus of the class indicated which is capable of rapid operation, and with this object in view my invention consists in constructing the said conveying device in the form of a rotary frame on which the said roll or gripping apparatus is mounted, and which is continuously rotated for moving the said gripping device across the bottom face of the pile.

Another object of the improvements is to provide apparatus for taking the sheets from the conveying device, and with this object in view my invention consists in associating a rotary drum with the said conveying device, the said drum having a gripper arm pivotally mounted eccentrically of its axis and in position for gripping a sheet conveyed thereto by said conveying device, the said gripping device being yieldingly connected with means for imparting rocking movement thereto for moving the same into positions respectively for taking a sheet from said conveying device and for releasing the said sheet.

Other objects of the improvements will appear from the following description.

For the purpose of explaining the invention several examples embodying the same have been shown in the accompanying drawings in which the same reference characters have been used in all the views to indicate corresponding parts. In said drawings

Fig. 1 is a top plan view of the apparatus partly in section,

Fig. 2 is a sectional elevation taken on the line 2—2 of Fig. 1 and showing one of the rotatable members in position for taking a sheet from the pile and another rotatable member in position for delivering a sheet to a receiving device adapted to carry the said sheet to an apparatus for further treatment of the sheet,

Fig. 3 is a sectional elevation similar to the one illustrated in Fig. 2 and showing one of the rotatable members in an intermediate position in which it has taken a sheet from the pile,

Fig. 4 is an end elevation of the apparatus showing the gearing for driving the operative parts of the apparatus and the suction head forming a part of the gripping device,

Fig. 5 is a sectional elevation taken on the line 5—5 of Fig. 1,

Fig. 6 is a detail view showing the cam controlling the movement of the gripping member mounted on the sheet receiving drum, the said view being taken in the direction of the arrows 6—6 of Fig. 1,

Fig. 7 is a detail view showing a part of the gripper controlling mechanism,

Fig. 8 is a detail sectional view taken on the line 8—8 of Fig. 4 and showing a portion of the suction head,

Fig. 9 is a detail view showing the gripping roll in inoperative position,

Fig. 10 is a fragmentary sectional elevation showing a modification of the gripping disks,

Fig. 11 is an elevation on an enlarged scale showing a part of the pile supporting means,

Fig. 12 is a top plan view of the upper part of the supporting means shown in Fig. 11,

Fig. 13 is a bottom view of Fig. 11 showing another part of the said supporting means,

Fig. 14 is a side elevation of Fig. 13,

Figs. 15–18 are diagrammatical elevations showing modifications of the conveying device,

Figs. 19 and 20 are fragmentary elevations showing a modification of the gripping device, and

Figs. 21 to 23 are diagrammatical elevations

showing modifications of the pile supporting means.

In the example shown in the drawings the operative parts of the apparatus are mounted on a frame comprising side members 1 formed with arms 2 and 3 and a projecting portion 4. On the said frame three distinct devices are mounted, viz. a rotary device 5 supporting piles of sheets 6 and adapted to take therefrom the sheets, devices 7 holding the piles in position, and a rotatary drum 8 receiving the sheets from the device 5 and carrying the same to apparatus in which they are further treated.

The rotatary device 5 comprises two end plates 9 and 10 and one or more intermediate plates 11 all fixed to a shaft 12 rotatably mounted in bearings 13 provided in the side members 1. On the said plates 9, 10 and 11 gripping rolls and pile supporting rollers 40 are rotatable. The gripping rolls comprise tubular shafts 14 each extending from the end plate 9 to the end plate 10. At one of their ends the said tubular shafts have sleeves 15 fixed thereto which are rotatable in bearings 16 made in the plates 9, and at their opposite ends the shafts are fixed to hubs 17 rotatably mounted on trunnions 18 fixed in bores of the plate 10. On the tubular shafts 14 gripping or suction disks 20 are mounted which are adapted to be fixed in position on the shafts by means of screws 21, and which are spaced from one another by disks 22. The said spacing disks 22 are formed with cut-out portions 23 the end walls of which provide abutments for rods 24 extending through bores made in sets of three disks 20. As shown the disks 20 and 22 are combined into sets each comprising three disks 20 and two disks 22, which each set is associated with a support for a pile of sheets to provide a gripping and conveying device for a sheet conveying station, the apparatus being provided with a suitable number of stations two of which have been illustrated in Fig. 1. The said rods 24 carry nuts at their ends adapted to clamp the disks 20 and 22 together. The disks 22 are fixed to the shafts 14 by means of screws 19, and the disks 20 may be set into different angular positions relatively thereto and with the rods 24 bearing on either one of the abutments provided by the notches 23 for setting the gripping disks 20 of any station into and out of operative positions, as will be described hereinafter.

As is shown in Fig. 2, the gripping disks are provided each with a socket 26 in which a suction cap 27 is located which is formed with an axial bore, and which communicates through an inwardly directed extension of the socket 26 and a hole 28 made in the wall of the tubular shaft 14 with the inner part of the said shaft, for producing suction within the cap 26. The outer face of the end plate 9 is formed with a finished portion 30 which is loosely engaged by a segmental suction head 31 disposed concentrically of the shaft 12. The said suction head is formed with a segmental cavity 32 and it is elastically held in contact with the surface of the portion 30 by means of coiled springs 33 located between the outer face of the head 31 and a plate 34 secured to the side member 1, pins 35 being fixed to the head 31 and loosely engaging holes made in the plate 34 for holding the head 31 and the springs 33 in position. The cavity 32 is adapted to be thrown into communication with the hollow of the shafts 14 and to be disconnected therefrom as the plates 9, 10 rotate, as will be described hereinafter. The head 31 is connected by a pipe 36 with a vacuum chamber or other suction device.

The suction head 31 is provided at both ends with ears 29, and at their inner sides the said ears are formed with cut-out portions in which slides 37 are embedded by means of which the length of the segmental cavity 32 may be varied for timing the connection of the hollow of the shafts 14 and the suction caps 27 with the said cavity and the suction chamber. The said slides are fixed in set positions by means of screws 38 engaging in slots 39.

As appears from Figs. 2 and 3, in the example shown in the figures three suction rolls 14, 20 are provided, which are displaced relatively to one another at angles of 60°. But I wish it to be understood that my invention is not limited to the number of the suction rolls shown herein.

Further, I wish it to be understood that my invention is not limited to the use of the gripping means shown herein and operated by suction.

Between the suction disks 20 the aforesaid pile supporting rollers 40 are located which provide rigid bottom supports for the pile. As shown the said supporting rollers are smaller in diameter than the gripping disks, and they are located close to one another and as near as possible to the suction disks 20. The supporting rollers 40 are located near the circumference of the plates 9, 10 and 11 on a concentric circle and their outer portions provide a concentric support for the pile of sheets. They are rotatably mounted in the plates 9, 10 and 11, and at one of their ends they have trunnions 41 fixed in sockets, which are rotatable in bores of the plate 10.

To the shaft 12 disks 42 are secured one for each station, and the said disks are formed with wings 43 extending between successive suction disks 20 and providing guiding members for the sheets of paper taken from the pile as will be described hereinafter.

The shaft 12, the rolls 14, 20 and the rollers 40 are provided with mechanism for imparting rotary movement thereto, which will be described hereinafter.

The pile of sheets 6 supported on the rollers 40 is held in position by the following mechanism: On a rod 46 fixed to the arms 2 of the side members two split rings 47 and a split ring 48 are clamped by means of screws 49. The rings 47 are cast integral with a downwardly directed bail 58 formed with an internally screw-threaded eye 50 engaged by a screw-threaded spindle 51 carrying a milled disk 44 the said spindle being adapted to be fixed in position by nuts 45. On the reduced end 52 of the said spindle 51 a bail 55 is pivotally mounted which is formed at its ends with eyes 56 to which a rod 57 is secured. The split ring 48 is formed with an upwardly directed internally screw-threaded eye 60 which is engaged by a spindle 61 adapted to be fixed in position by nuts 59. On the reduced end of the said spindle a bail 62 is pivotally mounted eyes 63 of which carry a rod 65. To the outer ends of the rods 57 and 65 upright rails 66 are secured which carry laths 67. The said laths provide supports for the pile 6 as is shown in Fig. 3. To the bottom ends of the laths sheet metal tongues 68 are secured which extend into position between the disks 20, and which are bent inwardly at their bottom ends and towards the said disks, as is best shown in Figs. 2 and 11.

The laths 67 are adapted to be set into different positions according to the character of the sheets

of the pile 6, and more particularly they may be elevated and inclined from the vertical more or less and shifted with the tongues 68 circumferentially of the gripping device 5. For thus setting the laths 67 the split rings 47 and 48 and the nuts 45 and 59 are loosened, the spindles 51 or 61 are screwed inwardly or outwardly, and the split rings are set circumferentially of the rod 46 and fixed again in position.

To the ends of the upper rods 65 arms 70 are fixed by means of clamping plates 71, and the said arms carry laths 72 which engage the pile 6 at its ends. The said laths 72 may be set in different positions in accordance with the breadth of the sheets by shifting the arms 70 longitudinally of the rods 65.

It will be understood that laths 67 and cooperating mechanism are provided for each station of the apparatus, Fig. 1 showing two of such stations and pile supporting means 67.

At the side of the sheet conveying device 9, 10, 11, 12 remote from the pile supporting devices 67, 72 the said sheet receiving devices 8 one for each station are provided. As appears from Figs. 1 to 3, 6 and 7 the said sheet receiving devices comprise disks 75, two for each station, fixed to a shaft 76 rotatably mounted in the side members 1, 1 and adapted to be rotated by mechanism to be described hereinafter. On each disk a gripping arm 77 is mounted, and all the arms 77 are mounted on a pivotal shaft 78. The said gripping arms are adapted to be moved from the position shown in Fig. 2 in dotted lines into the position shown in full lines, while the drums 8 perform their rotary movement. Each gripping arm is loosely mounted on the shaft 78 and it is adapted to be moved into and out of gripping position by a pin 79 fixed to the shaft 78 and acting on the gripping arm 77 through a coiled spring 80, the said spring being provided for adapting the gripping arm to sheets or folded sheets of different thicknesses. The pins 79 bear on pins 74 fixed to the gripping arms, the said pins 74 retracting the gripping arms when the shaft 78 is turned clockwise. Near one end the shaft 78 is mounted in an eye 81 carried by an arm 82 fixed to the shaft 76, a counter weight 83 being provided for balancing the eye 81 and the parts connected therewith. To the end of the shaft 78 an arm 84 is secured which carries a roller 85 engaging in a cam groove 86 made in a disk 87 fixed to the side member 1. As is shown in Fig. 6 the disk is fixed in position by means of screws 89 passing through slots 88, so that the disk 87 and the cam groove 86 may be adjusted in position.

The driving mechanism of the parts of the apparatus is constructed as follows: To a shaft 90 which is rotatably mounted in the side member 1 of the frame a pulley 91 and a pinion 92 are secured. The said pinion is in engagement with a loose gear wheel 93 and the said gear wheel 93 is in mesh with a gear wheel 94 secured to the shaft 12. Thus, rotary movement is imparted to the plates 9, 10 and 11. The hubs 17 are made integral with gear wheels 95, and the trunnions 41 are made integral with pinions 96, and the said gear wheels 95 and pinions 96 are in mesh with an internal gear 97 fixed to one of the side members 1 of the frame, spacing members 98 being provided between the said side member 1 and the internal gearing 97.

The gear wheel 92 is in mesh with a loose gearing 100, which is in mesh with a gear 101 secured to the shaft 76.

The operation of the apparatus is as follows: Piles of sheets of folded or unfolded paper or the like are placed on the rollers 40 in position for being laterally supported by the laths 67 and 72. The proper position of the laths 67 regulated by setting the split rings 47 and 48 and the screws 51 and 61 into the proper positions after first loosening the split rings 47 and 48. Thus the height and the angularity of the laths 67 and also the position of the tongues 68 relatively to the conveying device comprising the rolls 14, 20 and the rollers 40 is adjusted. As appears from Fig. 2, the rollers 40 provide a cylindrical support for the pile, and the suction caps 27 slightly project beyond the outer circumference of the series of rollers 40, so that the said caps safely engage the sheets of paper.

If only a part of the conveying devices is used, the suction apparatus of the other conveying devices is made inoperative by turning the disks 20 from the positions shown in Fig. 2 in which the rods 24 bear on the right hand end wall of the notch 23 anti-clockwise and into positions with the left hand end walls of the said notches bearing on the rod 24, thus shifting the socket 26 out of communication with the hole 28 of the tubular shaft 14.

Now the operation of the apparatus is started, and the conveying device is rotated in the direction of the arrow x shown in Fig. 2. The suction caps 27 of the left hand set of disks 20 are now in position for engaging the left hand or front end of the lowermost sheet of the pile 6, and at this moment the said suction caps and their sockets 26 are in communication with the suction apparatus through the tubular shaft 14, the cavity of the suction head 31 and the pipe 36. Thus the lowermost sheet is gripped at its left hand end. As the conveying device 5 continues its rotary movement the disks 20 are rotated anticlockwise, as is indicated by the arrow y, by the engagement of the gear wheel 95 with the internal gear 97. The circumferential velocity of the disks 20 is equal but opposite to the circumferential velocity of the conveying device 5 and therefore the said disks roll on the lower face of the lowermost sheet without friction so as to peel the lowermost sheet from the pile.

In a similar way the rollers 40 are rotated in the direction of the arrow z so that also these rollers roll on the sheet without friction. But I wish it to be understood that my invention is not limited to the construction herein described in which the rollers 40 move on the sheet without friction, and that in some cases slight friction may be desirable, as will be described hereinafter. Such slight friction may be accomplished by varying the gear ratio of the gearings 96 and 97.

The sheet which has thus been taken from the pile is carried along by the disks 20 engaging the same, Fig. 1 showing three successive disks for each station. In the position of the parts shown in Fig. 2 the disks 20 located at the left of the conveying device 5 have engaged the lowermost sheet with their suction caps 27, and they are about to peel the same from the said pile. In Fig. 3 the conveying device has proceeded so far that the said disks are in the upper or intermediate position in which the sheet is placed around the same and held in position by the disk 42, 43. In Fig. 2 the right hand disks 20 have arrived in position for transferring the sheet to the receiving device 8. The grippers 77 are swung from the position shown in Fig. 2 in dotted lines into the position shown in full lines, in which

they engage the sheet, the said swinging movement of the grippers being caused by the roller 85 carried by the shaft 78 passing from the portion of larger diameter of the groove 86 into the portion of smaller diameter thereof. Thus the sheet is taken from the device 5 and transferred to the receiving device 8 by means of which it is carried to another apparatus for further treating the sheet, for example to an apparatus for assembling folded or unfolded sheets. As the sheets are successively taken from the pile, the remaining sheets gradually follow by gravity and the said gradual movement is assisted by the construction of the supporting rollers 40. The parts of the said rollers engaging the pile are spaced from one another so as to provide gaps into which portions of the sheets are sunk, and as the rollers continue their movement the pile is slightly vibrated. Thereby the sheets of the pile are made loose from one another and from the tongues 68. The tongues 68 loosely arrest the edges of the lowermost sheets by their curved shape so that single sheets are taken from the pile. The shape of the said tongues is adapted to the thickness and elasticity of the sheets, and tongues of various shapes and curvatures are kept in store and selectively mounted in the apparatus, in accordance with the character of the sheets, so that sheets of any thickness and elasticity are individually taken from the pile. The main part of the weight of the pile is supported on the rollers 40, but a small component of the said weight acts on the laths 67 and the tongues 68 to produce a certain friction for braking the downward movement of the pile more or less, and the said friction is varied by varying the height and the angularity of the laths 67 and the component of the weight of the pile acting on the said laths. Thus the front edge of the sheet being taken from the pile is relieved of pressure particularly in case of thin sheets.

The rotary movements of the rolls 20 and the receiving device 8 are timed so that the rolls 20 engage the front portion of the sheet to be taken from the pile 6 when the suction cap 27 is in the position shown in Fig. 2, and that the gripper arm 77 is moved into the position for gripping the sheet when the roll arrives in the position for delivering the sheet to the receiving device 8. In the example shown in the figures three rolls 20 and one gripping arm 77 are provided, and, therefore, the receiving device 8 performs a complete rotation while the conveying device 5 is rotated through an angle of 120°, and the sheets are removed from the conveying device after rotation thereof through an angle of 120°. Accordingly the gear ratio of the gear wheels 94 and 101 is 3:1. The vacuum supplied to the suction cap 27 is controlled so that it is transmitted to the said caps exactly when the caps are in the position for engaging the left hand front margin of the sheet, and the said vacuum is maintained until the suction caps arrive in the position in which the gripping arms 77 take hold of the sheet, whereupon the vacuum is removed. The supply of the vacuum is exactly timed by means of the slides 37. The gripping arms 77 are controlled so that they get into the positions shown in Fig. 2 in full lines when the sheet has arrived in the position for being delivered to the sheet receiving device 8. They are operated by means of the roller 85 engaging in the groove 86 made in the disk 87, and for properly timing the operation the disk 87 is adapted to be adjusted in position by the screws 89 engaging in the slots 88.

It will be understood that my invention is not limited to a construction in which the conveying device is equipped with three rolls 20. In Fig. 15 I have shown a modification in which a single roll 110 is provided on the conveying device, and Figs. 16 to 18 shows examples in which four and six rolls 111, 112 and 113 are provided. The diameter of the said rolls may be R, and the number of rotations made by each roll during a complete rotation of the conveying device n. If n is a whole number, the suction device 27 of the roll rotating within the conveying device is operative in the same position of the rolls relatively to the conveying device and after a complete rotation. If, however, n is a fraction, the suction cap 27 of the roll rolling within the conveying device is displaced within the conveying device through an angle corresponding to the denominator of the fraction, the said denominator giving the number of rotations of the conveying device after which the roll arrives again in its initial position relatively to the conveying device.

The number n also determines the angle included between the positions of the suction cap 27 in which the sheet is taken from the pile and in which it is transferred to the receiving device. For example, in the construction shown in Figs. 1 to 8, where three rolls are provided, the number n is 3, and accordingly the sheet is transferred to the receiving device after a revolution of the roll 20 through an angle of 360:3=120°. In the construction shown in Fig. 15 the diameter of the roll 110 is one half of the diameter of the conveying device and the number n is 2. Accordingly the angle through which the roll revolves within the conveying device into the position for delivering the sheet is 360:2=180°, and accordingly the sheet receiving device 8 is located at an angle of 180° away from the pile. In the modification shown in Fig. 16 the diameter of the rolls 111 is one third of the diameter of the conveying device, the number n is 3, and the angle of revolution of the roll from the pile to the sheet receiving device 8 is 360:3=120°. In the modification shown in Figs. 17 and 13 the diameter of the rolls is one fourth of that of the conveying device and accordingly the number n is 4. Therefore the angle through which the roll is revolved from the pile to the sheet receiving device 8 is 360:4=90°.

The number of the rolls which may be used in a conveying device is limited. In the example shown in Fig. 15, only one roll can be used and in the modifications shown in Figs. 16 to 18 one to eight rolls may respectively be used. On the number of the rolls depends the ratio of the number of rotation of the conveying device and the sheet receiving device. Where a single roll is provided in the conveying device the said ratio is 1:1, where two rolls are provided the ratio is 2:1, etc.

In some cases I prefer to provide the rolls 20 at the portions first engaging the front edges of the sheets with notches permitting the front edges to be bent away from the pile. This modification has been illustrated in Fig. 10. As is shown in the said figure the suction roll 103 is formed with a notch 104 having an inwardly directed wall 105 curved along a radius smaller than the radius of the circumference of the roll, and a portion 106 connecting the inner end of the said curved portion 105 with the circumference of the roll.

The suction head 107 opens to the said curved portion 106. The front edge of the lowermost sheet is spread away from the body of the pile and it engages in the said notch and on the portion 106 of the wall thereof, while the next sheet cannot follow the lowermost sheet, because it is arrested by the tongue 68.

Thick and comparatively stiff sheets or folded sheets may be made to enter the said notch by exerting thereon a certain rubbing action tending to bend the same inwardly and towards the roll, for example by rotating the rollers 40 at a circumferential velocity slightly smaller than that of the conveying device, for which purpose the gear ratios of the gearings 96 and 97 may be varied.

In the modification shown in Fig. 19 gripping needles 116 are provided for drawing the front parts of the sheets towards the rolls 20, preferably in addition to the suction devices. The said needles are fixed to levers 115 one for each roll 20, all the said levers being fixed to a shaft 117 extending through all the rolls 20 from one end of the apparatus to the other one and rotatably mounted on the said rolls. To one end of the said shaft an arm 118 is secured which carries a roller 119 engaging a cam 120 mounted on the plate 9 coaxially of the shaft 14. The said cam is provided with a slotted arm 120′ engaged by a screw 121 by means of which the angular position of the cam may be adjusted so that the needles 116 engage the lowermost sheet of the pile at the proper moment.

In the construction shown in Fig. 19 the needles 116 are pressed into the sheet in the direction of the rotation of the rolls 20. In the modification shown in Fig. 20 similar needles 126 are provided which engage the sheet in a direction opposite to the direction of the rotation of the roll 20. The said needles and the controlling mechanism thereof are mounted in a manner similar to that shown in Fig. 19.

As appears from the description of Figs. 1 to 6, the rollers 40 provide a rigid support for the pile by means of which the sheet is presented to the rolls 20 in the proper position. In Figs. 21, 22 and 23 I have shown modifications of the said rigid supporting means.

The construction shown in Fig. 21 is suitable in such cases in which comparatively low and light piles are supplied to the apparatus. In this case rotary movement of the rigid supporting means may be dispensed with. As shown, the said rigid supporting means consist of segmental plates 130 secured to disks 131 fixed to the shaft 12. It will be understood that the surfaces of the plates 130 are polished, so that the friction thereof on the pile is small.

In Fig. 22 I have shown another modification in which segmental plates 132 are provided for rigidly supporting the pile, the said plates being fixed by means of flanges 133 to arms 134 secured to the shaft 12. On rollers 135 rotatably mounted on the disks 9 and 10 and on the plates 132 endless bands 136 are trained. The rollers 135 are rotated in the direction of the arrows *z* by mechanism similar to that described with reference to Fig. 1 and driving the rollers 40. Thus, the endless bands 136 move across the bottom face of the pile without friction and they provide rigid supports therefor.

The modification shown in Fig. 23 is similar to the one described with reference to Fig. 22, and the same letters of reference have been used to indicate corresponding parts. However, in lieu of the segmental plates 132 rollers 137 are provided which are rotated in the same way as the rollers 135.

RUDOLF HEPP.

PUBLISHED

MAY 25, 1943.

BY A. P. C.

R. HEPP

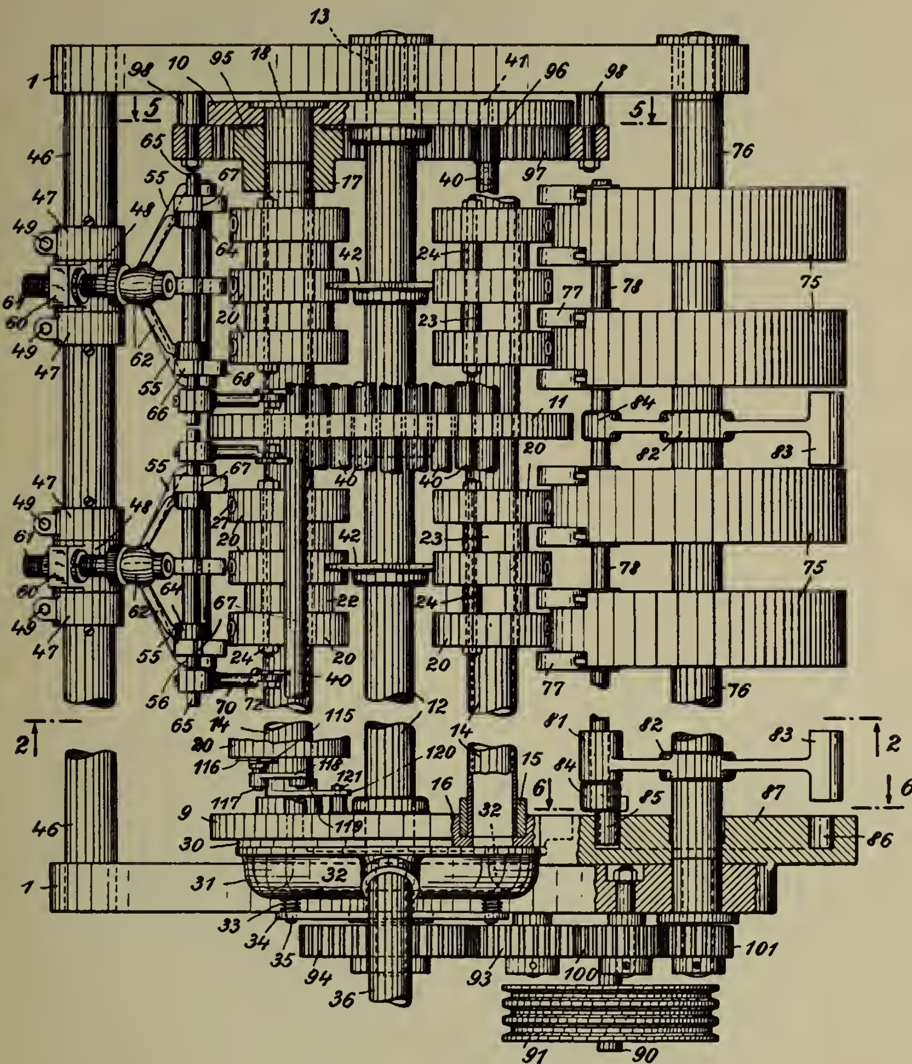
APPARATUS FOR TAKING FOLDED OR UNFOLDED SHEETS OF PAPER FROM A PILE THEREOF AND CONVEYING THE SAME TO A DEVICE FOR FURTHER TREATMENT

Filed April 17, 1942

Serial No. 439,378

6 Sheets-Sheet 1

Fig.1.



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PUBLISHED

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Serial No. 439,378

6 Sheets-Sheet 2

Fig.2.

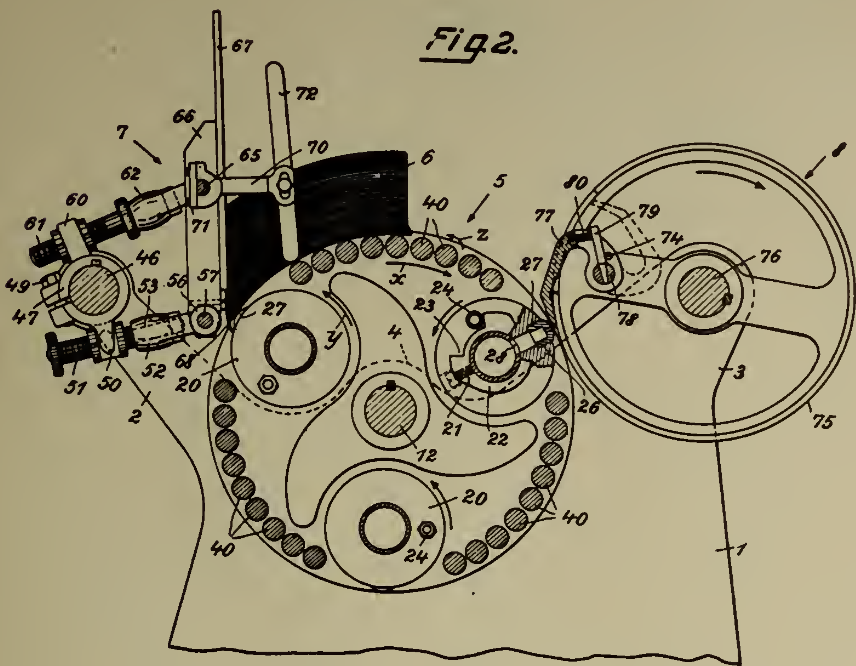
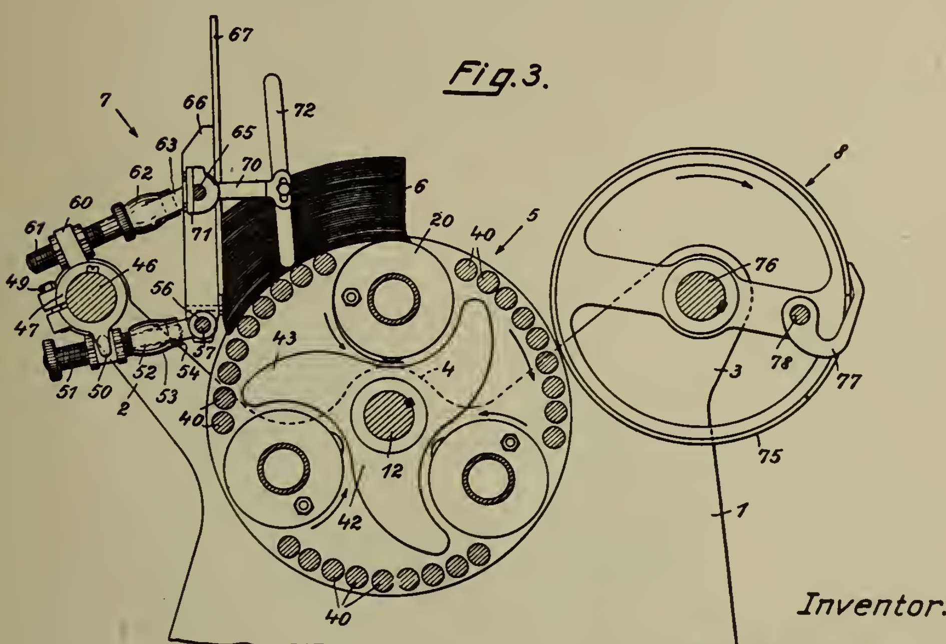


Fig.3.



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R. HEPP

APPARATUS FOR TAKING FOLDED OR UNFOLDED SHEETS OF PAPER FROM A PILE THEREOF AND CONVEYING THE SAME TO A DEVICE FOR FURTHER TREATMENT

Filed April 17, 1942

Serial No. 439,378

6 Sheets—Sheet 3

Fig. 4.

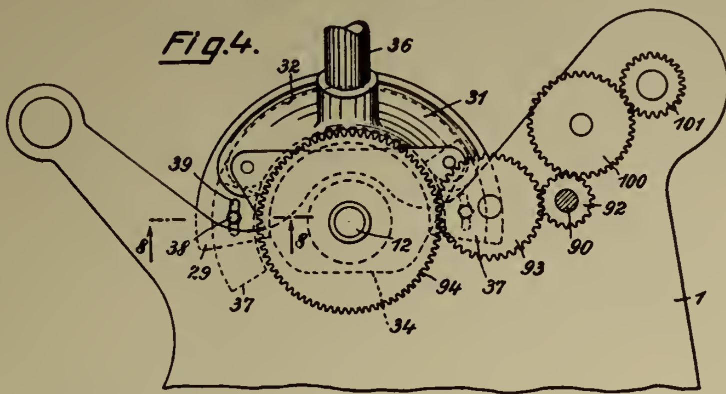


Fig. 5.

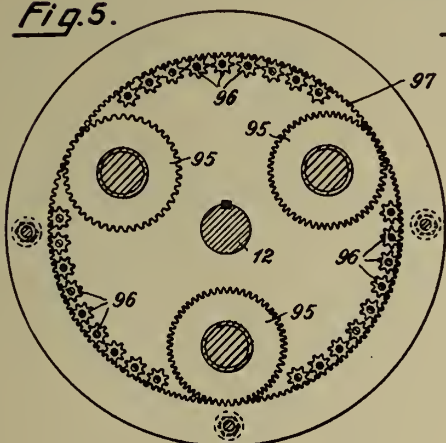


Fig. 6.

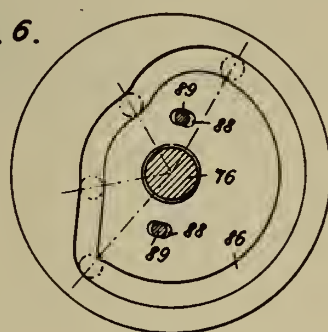


Fig. 7.

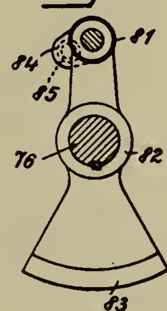


Fig. 10.

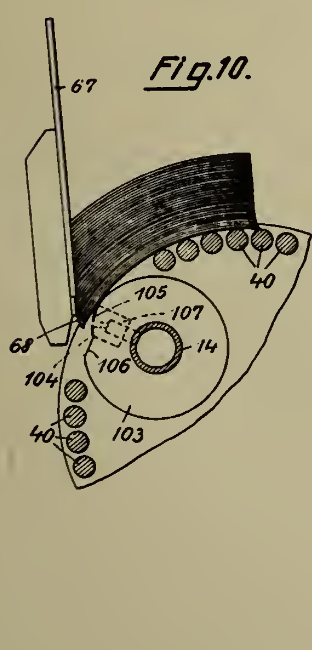


Fig. 8.

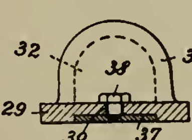
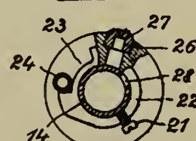


Fig. 9.



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PUBLISHED

MAY 25, 1943.

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APPARATUS FOR TAKING FOLDED OR UNFOLDED SHEETS OF PAPER FROM A PILE THEREOF AND CONVEYING THE SAME TO A DEVICE FOR FURTHER TREATMENT

Filed April 17, 1942

Serial No. 439,378

6 Sheets-Sheet 4

Fig.11.

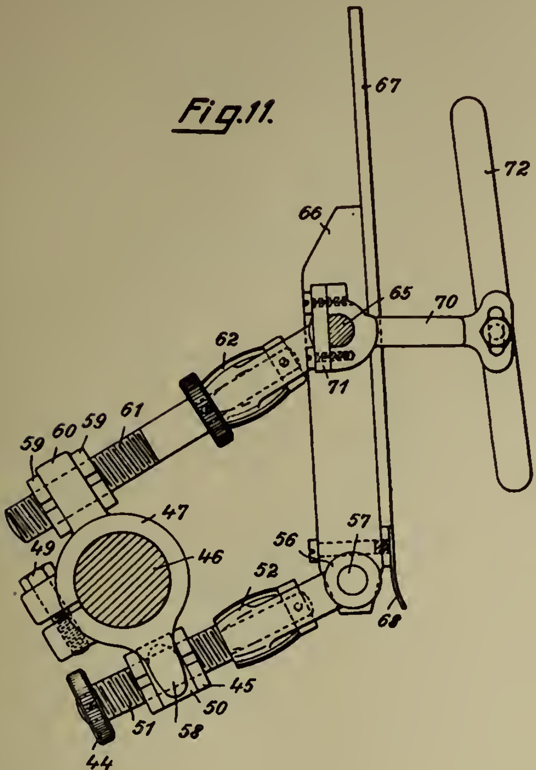


Fig.12.

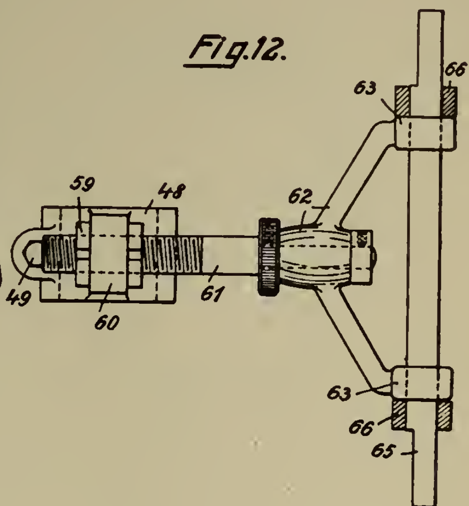


Fig.13.

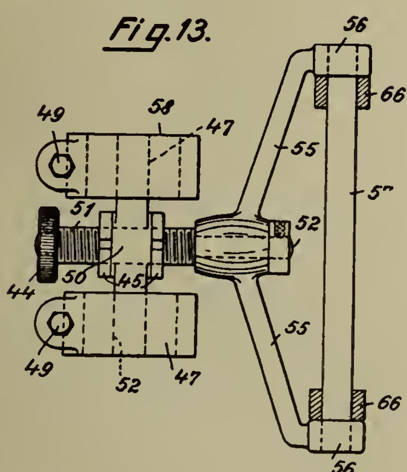
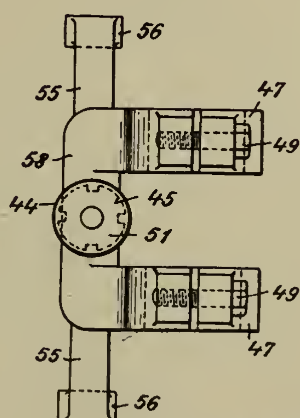


Fig.14.



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Filed April 17, 1942

Serial No. 439,378
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Fig.15.

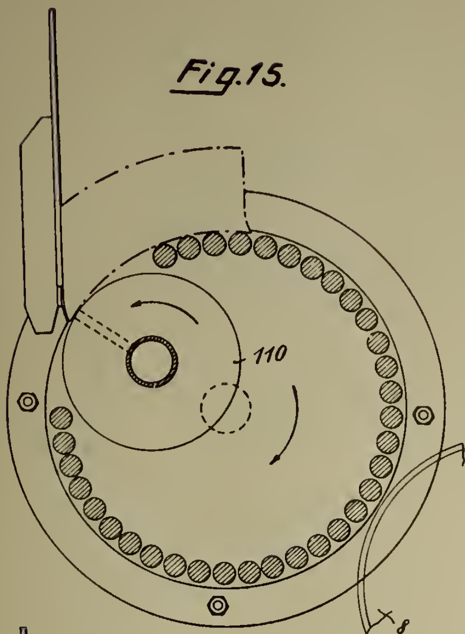


Fig.16.

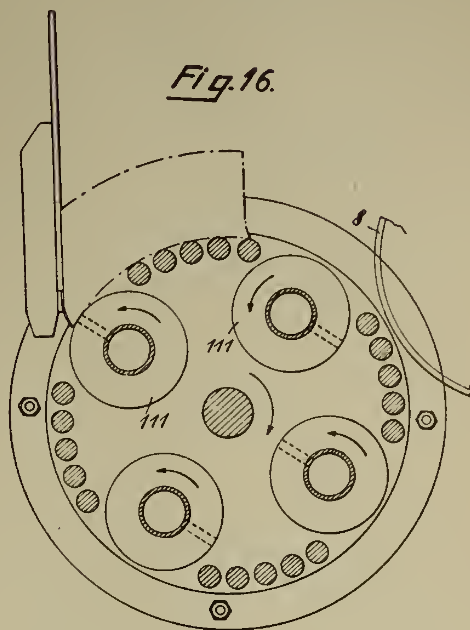


Fig.17.

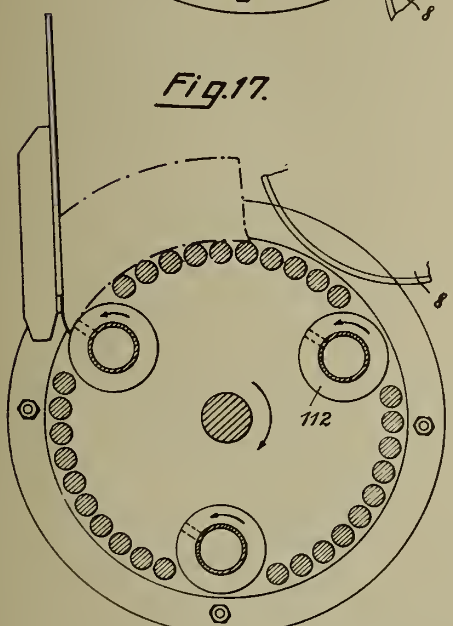
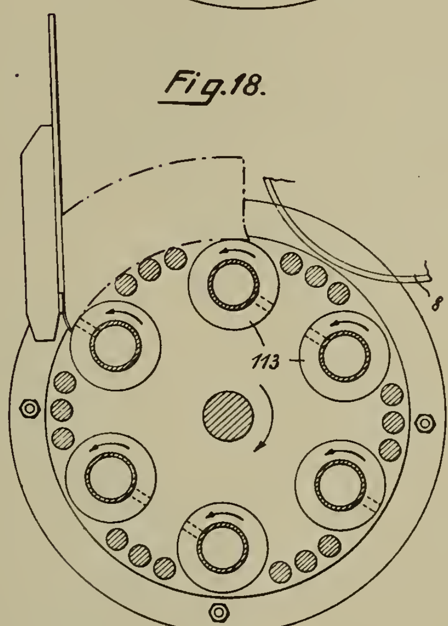


Fig.18.



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Filed April 17, 1942

Serial No. 439,378

6 Sheets-Sheet 6

Fig. 19.

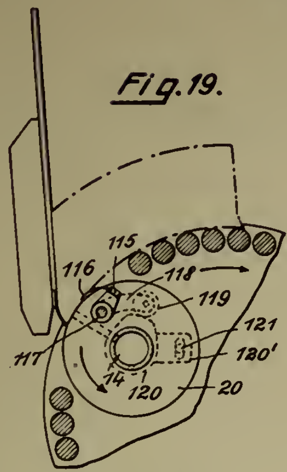


Fig. 20.

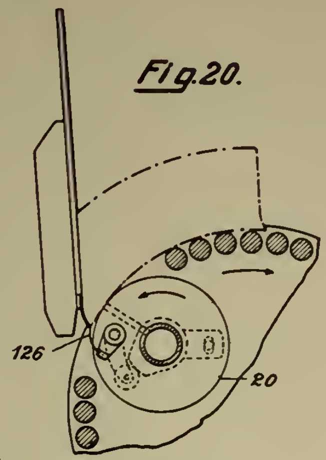


Fig. 21.

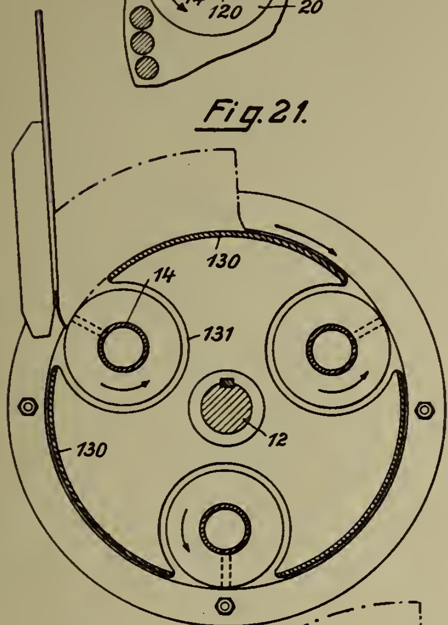


Fig. 22.

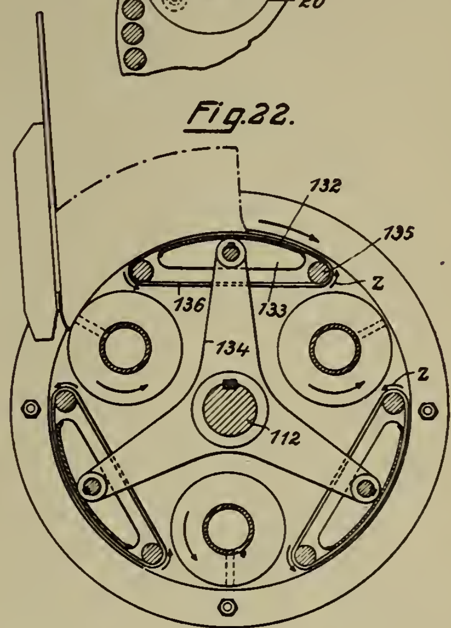
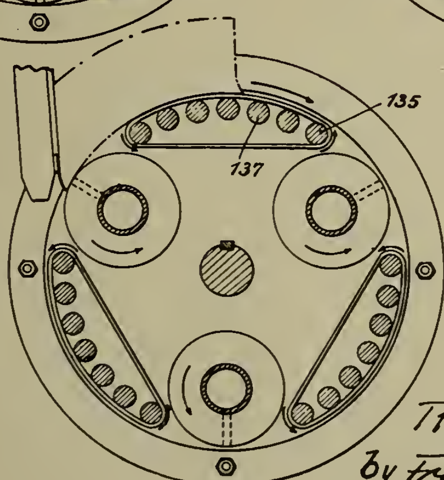


Fig. 23.



Inventor:

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Published May 25, 1943

Serial No. 440,037

ALIEN PROPERTY CUSTODIAN

PRESSING DEVICES WITH AN ENDLESS STRIP

Paul Vincent Thomas, Joinville-le-Pont, France; vested in the Alien Property Custodian

Application filed April 22, 1942

The present invention relates to improvements in devices intended to ensure the perfect regularity of the unwinding of cinematographic sound-films. It more particularly concerns the means allowing to obtain a good adherence between the film or films and a suitable regulating member as well as the means eliminating all the vibrations or disturbances produced in the defiling of films or the uniform rotation of the regulating member by the devices presently used for ensuring said adherence.

In the case of apparatus for recording, printing or reproducing sound-films, this regulating member is generally constituted by a braked flywheel of great inertia, rigid with the cylinder about which passes the film and on which, in most cases, the recording, printing or reproducing operation is effected. The film must ensure the rotation of said unit of great inertia, by simple adherence, or must be drawn along thereby, and this without the slightest slipping. Therefore said adherence must be rendered as perfect as possible, without prejudice, on the one hand, to the rigorously uniform and constant defiling of the film and without introducing on the other hand, any disturbance or vibration in the rotation of the cylinder.

The devices presently used for ensuring said adherence on the cylinder, and simultaneously the mutual adherence of a plurality of films which are caused to simultaneously defile in the case of printing on a cylinder, only rarely satisfy the three above mentioned conditions that is to say:

Maximum adherence;

Rigorously uniform defiling of the film;

Absence of introduction of disturbances or vibrations in the rotation.

These devices are generally constituted by one or more cylindrical rollers pressing on the film. For obtaining an acceptable adherence, a somewhat high pressure is necessary owing to the small surface of contact between said rollers and the film, which surface is reduced to the generatrices of contact of the cylinders. This very high pressure acting according to a line, whereas adjacent points are not pressed, is not without causing prejudice to the uniform defiling of the film and to the rotation of the cylinder.

One of the objects of the present invention consists in eliminating this very high pressure, localized at one point, and to replace it by a medium pressure uniformly distributed by means of an endless strip acting on a large portion AB of the surface of the cylinder, portion comprised in the angle α of Fig. 2 of the accompany drawing. The opening of said angle α is not limited and can easily reach a half-circumference in certain applications. Owing to such an arrangement, the system hereinafter described and forming the subject-matter of the present invention allows of obtaining the following conditions:

(a) Maximum adherence obtained by a medium pressure of the endless strip, uniformly distributed on the film according to a cylindrical surface as large as possible;

(b) No point whatever of the surface thus pressed can be subjected to vibrations and disturbances which might be generated by the mechanical members of the pressing device, said members never coming in contact with the film and the regulating cylinder and the endless strip being resilient.

The accompanying drawing intended to illustrate the invention, shows by way of example a simplified embodiment thereof. However it is to be understood that the invention is not limited to the embodiment illustrated which has been chosen only for facilitating the following explanations and descriptions.

In said drawing:

Figs. 1 and 2 illustrate in front elevation, the device forming the subject-matter of the invention in lifted position and in active position.

Figs. 3 and 4 are corresponding side views and

Fig. 5 is a plan view of the same device.

The pressing device with an endless strip according to the invention comprises, in the example under consideration, a support **2**, constituted by a multiple fork between the branches of which are mounted rollers **3** carrying the endless strip **4**. The number of rollers **3** which is two at the minimum, can be increased according to circumstances, in order to increase for instance the length of the arc of contact AB (see Fig. 2).

On the other hand, the support **2** has a part forming a shoe sliding in two slide-ways **10** so that the two following conditions are always satisfied: the axis of symmetry of the pressing device, which is also its axis of translation, always passes through the axis of rotation of the cylinder **1**; the axes of rotation of the rollers **3** always remain parallel in all the positions of operation, to the axis of rotation of the cylinder **1**.

In none of the positions of operation, at no moment whatever, whatever may be the opening of the angle α, must the rollers **3** come in contact with the cylinder **1**. In the particular case of

two rollers, the distance between the axes of the rollers must therefore be greater than $D+d$, D being the diameter of the cylinder 1, all thicknesses of films being included, and d being the maximum diameter of the cheeks of the rollers 3.

The length of the arc of contact AB of the strip 4 with the film or films 11 and consequently the value of the corresponding angle at the centre are adjusted by the height of support 2 relatively to cylinder 1. For that purpose, two abutment screws 8 coming in contact with abutments 9 are provided and allow said adjustment. The pressure of the endless strip on the film and the cylinder 1 is obtained by means of springs 6 attached at 7 and exerting a pull on the member 2, which has the effect of stretching the endless strip on the cylinder 1 until the abutment screws 8 touch the abutments 9. At this moment, the length of the arc of contact AB reaches the required value.

It is to be understood that the desired pressure might also be obtained either by any other spring system, or by the action of a lever connected with the support 2 and having a plurality of stopping positions, or by the rotation of an eccentric cam also having a plurality of stopping positions, or even by the very weight of the movable unit, etc.

The rollers 3 are mounted, as above explained, in such a manner that in all the positions of operation, their axis remains rigorously parallel to the axis of the cylinder 1 which they must never touch. They must run rigorously true and have the least possible resistance to rotation. The assemblage shown in the drawing is an assemblage between points. The needle screws are only diagrammatically illustrated and can have any other shape in particular at the end supporting the roller (cylindrical bearing, etc.). Any other bearing system can be contemplated, as long as it ensures the uniform rotation of the roller and without vibration.

Each roller can have the shape of a grooved pulley or of a roller having cheek members secured in position. It must, without prejudice to its ease of rotation, have a maximum inertia, ensuring the regularity of said rotation. The diameter at the bottom of the groove of the rolling track for the endless strip on said roller is a function of the available place; it must never be forgotten that by increasing the diameter, the inertia of the roller is increased.

The endless strip 4 is one of the main parts of the invention. The texture and homogeneity of said strip must remain rigorously constant at all points which successively pass on the arc of contact AB. The material constituting said strip must be flexible and resilient so as to be rigorously applied at all points of the cylindrical surface of contact.

Rubber is quite suitable for this purpose, but any other material possessing the required properties of homogeneity, flexibility, resiliency can be employed.

The cross section of the strip can be rectangular, semi-circular, trapezoidal or triangular according to circumstances. Its width must be such that it presses on the greatest possible width of the film 11.

The length of the endless strip depends on the diameter of the rollers and on the distance separating their axes. Whilst complying with the condition above mentioned, according to which the distance between the axes of the rollers must be greater than $D+d$ (in the particular case of two rollers), it is advantageous not to increase too much said distance between the axes. In fact, if this was so, a vibratory wave might be created of prejudicial amplitude in the parts of the strip between the rollers and the cylinder. Said vibratory wave will be so much the less important as the strip is thicker and as said portions stretched between the rollers and cylinder are shorter.

In position of rest, the endless strip between the two rollers must have a certain amount of "slack" (Fig. 1). This slack of the strip when at rest will be so much the smaller as the arc surrounded by the strip upon operation, is smaller.

The application of the means which have just been described, allows, as will be understood, of obtaining on a film in movement, stretched around a rotating cylinder, a uniform pressure distributed over a large surface; it allows of thus increasing the adherence of said film on the cylinder or the adherence of a plurality of films, of eliminating any slipping and of avoiding, in the rotation of the cylinder and in the defining of the film or films, all the vibrations or other disturbances due to the pressing devices usually employed.

PAUL VINCENT THOMAS.

PUBLISHED	**P. V. THOMAS**	**Serial No.**
MAY 25, 1943.	PRESSING DEVICES WITH AN ENDLESS STRIP	**440,037**
BY A. P. C.	Filed April 22, 1942	2 Sheets-Sheet 1

Fig. 1

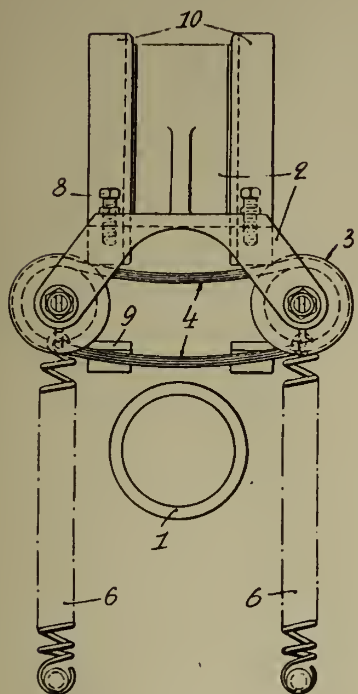


Fig. 2

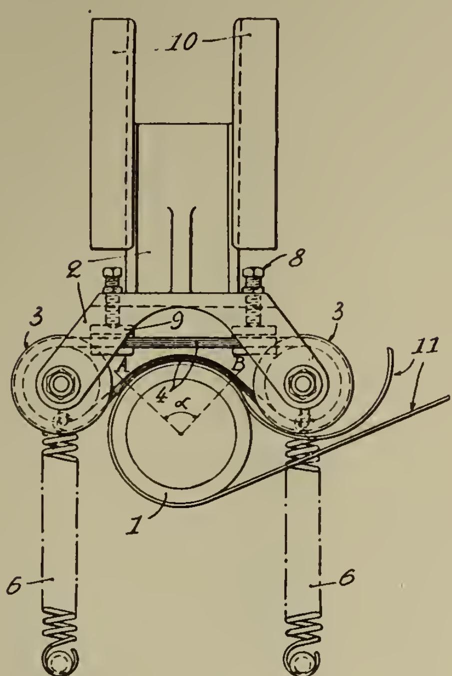
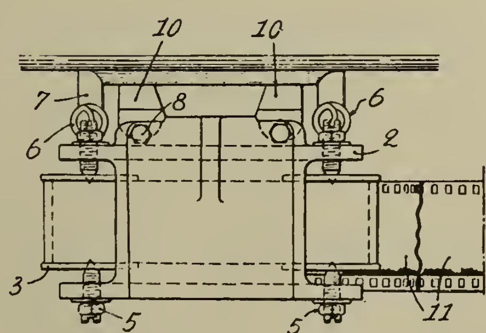


Fig. 5



INVENTOR
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By [signature]
his Att'y.

PUBLISHED

MAY 25, 1943.

BY A. P. C.

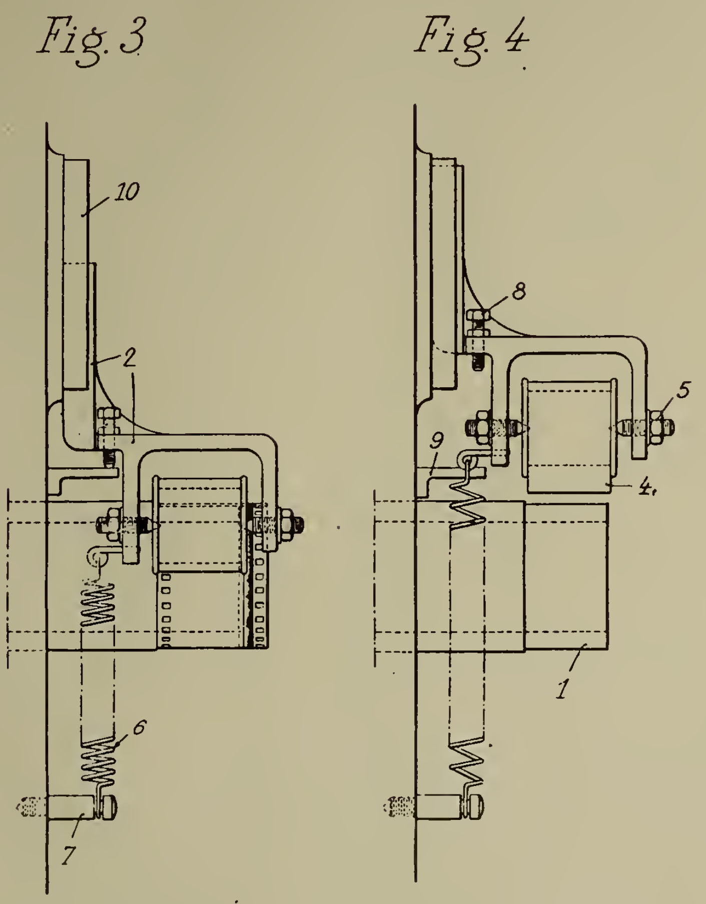
P. V. THOMAS

PRESSING DEVICES WITH AN ENDLESS STRIP

Filed April 22, 1942

Serial No. 440,037

2 Sheets-Sheet 2



Paul Vincent Thomas
INVENTOR
By [illegible]
his ATTY

Published May 25, 1943 Serial No. 441,859

ALIEN PROPERTY CUSTODIAN

CARBURETTORS

Claude Etienne Bonnier, Neuilly-sur-Seine, France; vested in the Alien Property Custodian

Application filed May 5, 1942

The present invention relates to carburetors adapted for injecting into the carburation chamber or into the admission piping a determined volume of fuel with a view to perfecting the proportions of the carburetted mixture when a variation occurs in the working condition of engines or motors.

The object of the said invention is a device which allows to effect this injection in such a maner that it can be obtained in the best "volume" and "time" conditions and, also, that it can be automatically avoided when it is not indispensable and, in particular at the "stopping" moment and "while" the motor is stopped.

In this device, the injection is produced by the direct effect of the partial vacuum existing either behind or ahead of the gas throttle and this in opposition to a mechanical effort which prevents or stops the injection when the partial vacuum has, or assumes, too low a value.

The description which will follow, with referene to the appended drawing, given by way of nonlimitative example, will allow a thorough understanding of how the invention can be embodied, those peculiarities which appear in the drawing as well as in the text constituting of course a part of the said invention.

Figures 1 and 2 are diagrammatical sectional views showing well known injection devices.

Figure 3 is a diagrammatical sectional view representing the utilisation of the injection device according to the invention in conjunction with a carburetor of the so-called "variable air" type.

Figure 4 shows in diagram form the utilization of the injection device object of the invention in conjunction with a carburetor of the so-called "constant air" type, the said carburetor comprising those special arrangements which are described in my application for U. S. Patent corresponding to my French patent filed on April 1st, 1941.

The said special arrangements relate, in Figure 4 of the present application, to the actuating and controlling of the throttle by a manometric relay.

Figures 5 and 6 represent in diagram form and, in order to render the drawing clearer, on a larger scale, detail elements constituting a part of the invention.

In the known device represented on Figure 1, the injection is effected by the expansion of the spring *1a* which pushes the piston **2** when the rod **3** is actuated in the direction shown by the arrow **4** when the gas throttle **5** is opened.

At this moment the special injection nozzle **6** discharges the fuel under pressure into the main diffuser **7** of the carburetor.

An inconvenience of this method lies in the fact that if the lever **8** of the throttle **5** is operated while the engine is stopped, the said operation determines at the same time the discharge of the jet nozzle **6**. In the case of a vertical carburetor of the type shown in Figure 1, the fuel is then spread out under the diffuser **7** which condition leads to fire risks in case of back-firing.

In the case of a horizontal carburetor and better still in a carburetor of the so-called "inverted" type, the admission piping is then "flooded", that is to say super-carburetted by the injected fuel, which condition leads to serious difficulties when it is desired to set the engine going again and the latter is hot.

In an other known device represented on Figure 2, the injection is obtained by the expansion of the spring **1** when the partial vacuum transmitted above the membrane *2a* by the conduct **3** connected to the gas admission piping ahead of the throttle **5** is insufficient to balance the stress of the said spring **1**.

The operation of the membrane *2a* is, in this case mechanically independent of the movements of the lever actuating the throttle **5** and the drawbacks of the device shown in Figure 1 do not occur while the motor is stopped.

But they are to be experienced again, in an identical fashion, each time the motor stops so that if, for example, several successive efforts for setting the engine going are made and are, for any reason, fruitless, they determine a repeated spraying by the injector nozzle **6**, which condition results in aggravating the drawbacks already explained.

In the case illustrated in Figure 3 the device object of the invention has been represented acting in conjunction, by way of example, with a known type of carburetor in which a piston **1**, mounted or not with a spring **2**, controls by its displacements, both the cross section of the passage way for the air into the conduct *3a* connected at *3b* to the admission piping of the engine, and by the needle valve **4** the discharge of fuel through the nozzle *5a* in order to produce the carburetted mixture distributed by the throttle **5**.

The partial vacuum prevailing ahead of the throttle **5** is transmitted by a conduct **7** to the upper surface of the piston **1**, the opposite surface of which is subjected to the atmospheric pressure established by means of an orifice **8**.

Moreover the throttle **5** is provided with a compression lever **9** which maintains a needle valve **10** open against the expansion of a spring **11** when the said throttle **5** is in its closed position.

A conduct **12** communicates on the one hand with the atmospheric air through the seat **13** of the valve **10** and on the other hand through the calibrated orifice **14** with the inside of the cylinder **15** above the piston **1**, finally by a conduct **16** with a vessel **17** closed by a membrane **18**.

The opposite side of the membrane **18** carries a groove provided in a metallic organ **20** secured

onto the membrane. In the groove 19 rollers 21, 21', can slide, said rollers being mounted on the levers 22 and 22' which are jointed at a fixed point 23. At the other extremity of the levers 22 and 22', rollers 24 and 24' rest on the upper surface of a membrane 25 continually pushed away by a spring 26 which rests on the lower wall of a receptacle 27. (This membrane and lever device is represented on a larger scale on Figures 5 and 6). The space between the two membranes communicates with the atmosphere by a hole 27*a*.

Clap-valves 28 and 29 allow the receptacle 27 to communicate with the constant level float-chamber 30 of the carburetor by means of the canal 31 and with the injection nozzle 32 by the conduit 33.

The whole system operates as follows:

In the position of the throttle 5 shown on Figure 3 and which corresponds to a no-load, low-speed operation of the engine, the valve 10 is lifted and the admission of air through 13 destroys the partial vacuum behind the choke 14 in the conduct 16 and in the vessel 17. The spring 26, pushing on the levers 22 and 22' brings about, by means of these levers, a drawing together of the membranes 18 and 25. The membrane 25 thus causes a filling up of the receptacle 27 by means of the clap-valve 28 and the canal 31. The position of the various organs will remain unchanged if the engine stops and there will be no injection through the special nozzle 32.

In like manner "during the stop" of the engine, the absence of a partial vacuum in 3*a* will leave the above described system inert and there will be no injection, whatever be the operation of the throttle 5.

While the engine is operating and when the throttle 5 opens, the needle valve 10 will close the air admission port 13 after an adjustable displacement of the push-lever 9. The partial vacuum (created by the engine) which is transmitted to the cylinder 15 by the conduct 7 will be transmitted by the choke 14 and the conduct 16 to the vessel 17. This partial vacuum will draw the membrane 18 in an upward direction (on the drawing) and by means of the levers 22, 22' this membrane will bring about a downward movement of the membrane 25, in opposition to the action of the spring 26 as shown on the Figure 6, thereby effecting the injection of fuel into the carburation chamber 3*a*.

It becomes apparent that in this device, the membrane 25 with the receptacle 27 and the clap valves 28 and 29 constitute a suction and compression pump the suction valve 28 of which is connected to the constant level float-chamber 30 which constitutes a fuel reservoir and the compression clap valve 29 of which communicates with the additional carburation jet nozzle 32. The spring 26 constitutes an elastic means which automatically brings about the suction stroke of the membrane 25 for the filling up and charging of the pump. As for the membrane 18 and the vessel 17, these constitute a vacuum motive unit, which is connected by means of the conduct 16 to the admission piping of the engine and the function of which is to bring about the compression stroke of the membrane 25 in order to drive the fuel towards the additional jet nozzle 32 when the partial vacuum acts in the vessel 17.

The starting of the injection as well as the quantity injected may be easily determined by an adjustment of several factors such as, for example: the moment at which the needle valve 10 will close, the resistance of the spring 26, the braking effect (by the calibration 8) on the up-stroke of the piston 1, which by controlling the admission of the air into 3*a*, thereby controls the partial vacuum prevailing therein, that is to say the motive partial vacuum actuating the membranes 18 and 25. It can readily be understood that the retarding action on the opening of the piston 1 will result in momentarily increasing the partial vacuum acting on the membranes and thereby automatically the power with which the fuel is injected.

In the case shown in Figure 4, the displacements of the throttle 5 are not positively controlled but by means of a manometric relay; this relay comprises, as has been described in the aforementioned application for patent, a piston 34 sliding in a cylinder 35 and rigidly connected to the throttle 5 by the spindle 36, the rod 37 and the lever 38.

The piston 34 is subjected on one of its faces to the atmospheric pressure by means of the calibrated orifice 39, and on its opposite face, to the effect of the partial vacuum transmitted to the air-tight part 40 of the cylinder 35 by a conduct 41 and a calibrated orifice 42 opening into the admission piping of the engine after the throttle 5. A spring 43 continually pushes the piston 34 away towards the closed position of the throttle 5.

Finally, the movements of the piston 34 which result in the control of the admission of the carburetted gases by means of the throttle 5 are determined by the positive operation of an air admission valve 44 which causes the partial vacuum in 40 to vary so as to counterbalance the resistance of the spring 43.

Besides, the conduct 16 connects the vessel 40 of the manometric relay to the vessel 17 of the injection device, the constitutive elements of which are identical to those of Figures 3, 5 and 6 already described.

It is readily understood that "while the engine is stopped" and at the moment when the engine stops, the partial vacuum prevailing in 40 will be insufficient for bringing about the displacement of the membrane 18; there will consequently be no injection through the special nozzle 32.

On the contrary however, when the engine will be operating, the injection will occur each time that the partial vacuum in 40, transmitted to 17 by the conduct 16 will counterbalance or exceed the resistance of the spring 26.

As in the example shown in Figure 3, the time at which the injection will start as the quantity thereof can be controlled by the adjustment of several factors such as, for example: the relative stress of the springs 43 and 26 taking into consideration the ratio of the surfaces of the piston 34 and of the membrane 18, the deflection of the spring 26 and finally the braking effect which the calibration 39 has on the displacements of the piston 34.

It is quite obvious that the embodiments which have just been described are only examples limiting in no way the scope of the invention which comprises, on the contrary, all diversified forms of embodiment. In particular, the invention may be applied to carburetors other than those described.

CLAUDE ETIENNE BONNIER.

PUBLISHED	C. E. BONNIER	Serial No.
MAY 25, 1943.	CARBURETTORS	441,859
BY A. P. C.	Filed May 5, 1942	2 Sheets–Sheet 1

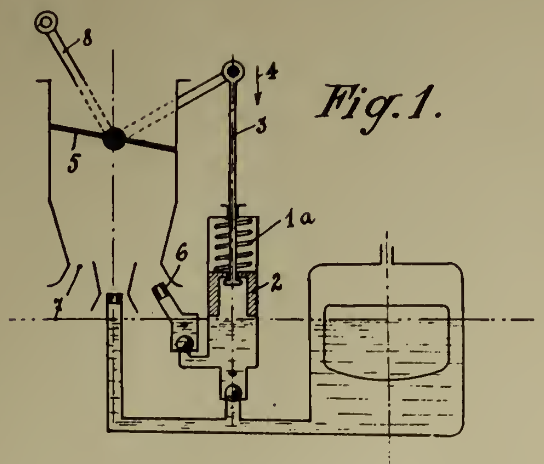


Fig. 1.

Fig. 3

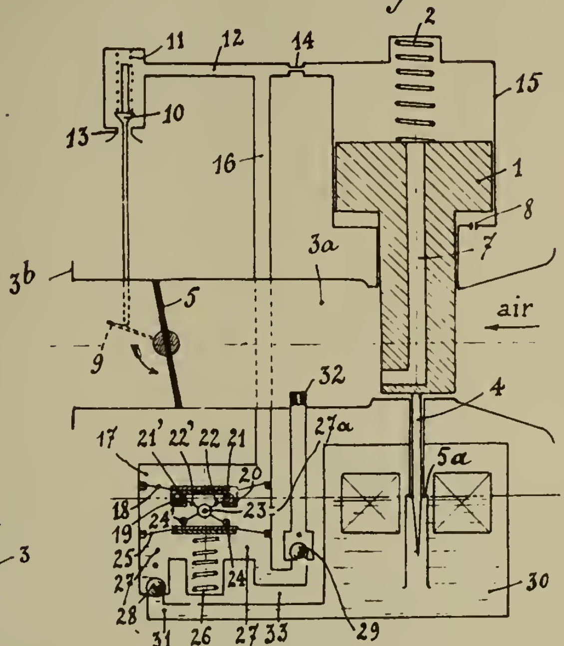
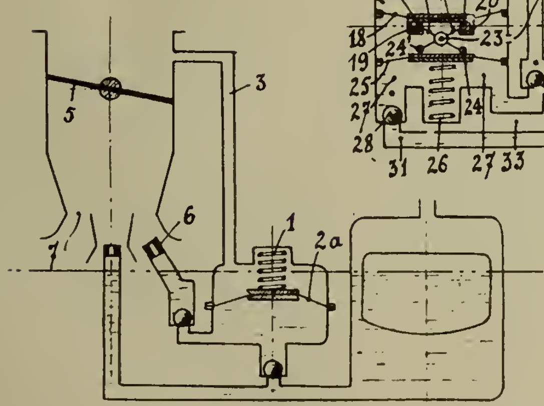


Fig. 2.



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CARBURETTORS

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2 Sheets-Sheet 2

Fig: 4

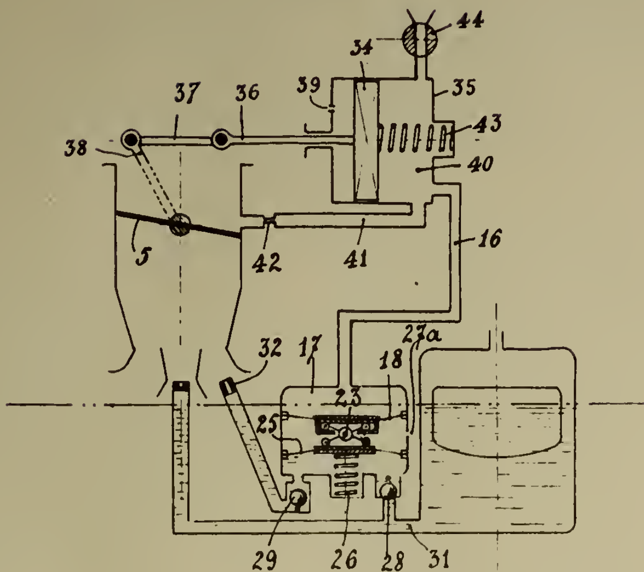


Fig: 5

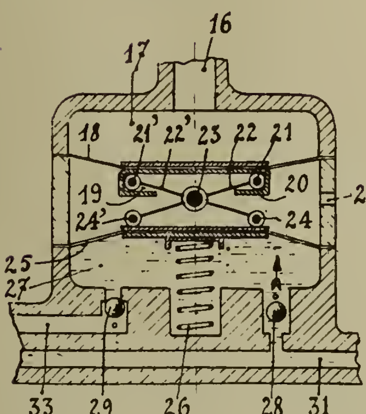
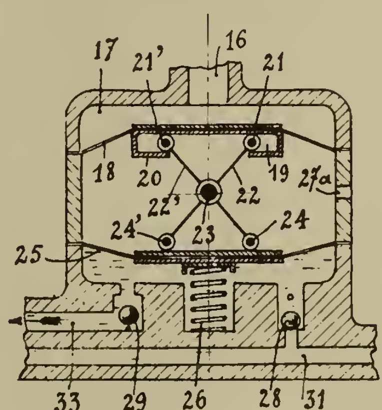


Fig. 6



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Published May 25, 1943

Serial No. 442,373

ALIEN PROPERTY CUSTODIAN

COUPLING SYSTEMS FOR LOADING DEVICES SUCH AS AERIALS

Pierre Paul Gamet, Paris, France; vested in the Alien Property Custodian

Application filed May 9, 1942

This invention has for its subject matter improvements in and relating to coupling systems for loading devices such as aerials.

The adaptation on a wide range of wave lengths of a feeder through a coupling box connected between the said feeder and the loading device or through adjustable self-induction coils connected in series on one of the strands of the said feeder obliges the operator to make a regulation for the different working wave lengths. This regulation is generally obtained by varying the electric constants of the coupling boxes or the self-induction coil connected in series in the feeder.

These adaptation circuits are expensive and require a large space.

The present invention has for its object to do away with these disadvantages and to permit of obtaining without different regulations a convenient adaptation of the feeder from the point of view of the voltage on a wide range of wave lengths.

On the other hand it is often necessary to vary the voltage of the high frequency generator which is transmitted by the feeder to any loading device. This variation is generally obtained by a modification of the connection of the high frequency generator with the feeder as, for instance, by means of variable taps on the self-induction coil of the oscillatory circuit. Such variable taps are of a difficult and delicate construction and do not permit an accurate regulation.

Another object of the invention is to remedy to this inconvenience and to provide a device permitting to control the coupling values in certain limits.

The same difficulties are encountered in the coupling systems for coupling two radio-electric wave generators connected in parallel when they are not well equilibrated.

Still another object of the present invention is to remedy to these inconveniences and to provide a device which compensates in a certain measure the differences in the energy produced by one of the radio-electric wave generators, these differences being due, for instance, to an accidental variation of the potential of the bias grid.

Improved coupling systems which permit to attain the above mentioned objects offer the characteristic features which result from the following description.

Coupling systems according to the invention are shown in the appended drawings, in which:

Figure 1 is a diagram of the coupling of a high frequency generator with a feeder with stationary waves through a fixed resistance.

Figure 2 is a diagram of the coupling of a high frequency generator with a feeder with stationary waves through a variable resistance.

Figure 3 is a diagram of the coupling of a feeder for stationary waves with two high-frequency generators connected in parallel.

The diagram shown in Figure 1 comprises a transmitter station 1 shown by an oscillatory circuit formed of a variable capacity 2 and of a self-induction coil 3; a tap 4 provided on the coil 3 is connected with a resistance 5 in series with the strand 6 of a co-axial feeder 7; the other extremity of this feeder is connected with the loading device 8 (an aerial, for instance).

The operation of this coupling system is as follows:

The resonance circuit transmits the high frequency oscillations which it produces to the loading device 8 through the medium of the resistance 5 and of the co-axial feeder 7. The input impedance of the unit formed of the co-axial feeder 7 and the loading device 8 varies in function of the wave lengths which are transmitted by the generator 1.

Owing to these variations of the impedance of the feeder 7 and of the loading device 8 in function of the wave lengths which are transmitted, the high frequency excitation voltage varies.

For a small input impedance, the high frequency excitation voltage is moderate and if the tap on the self-induction coil 3 corresponds to an excitation voltage which is higher than the voltage which had been foreseen, a voltage drop is produced on the terminals of the resistance 5.

Thus, the impedance between the tap 4 and the body seen from the transmitter side is increased owing to the resistance.

For a strong input impedance the high frequency excitation voltage is entirely transmitted; indeed, the value of the resistance 5 is negligible with respect to the input impedance of the feeder.

Thus, the resistance 5 tends to bring the loading impedance seen from the transmitter side to such a value that the fixed coupling is possible on the self-induction coil 3.

The transmitter plant shown on Figure 2 is similar to that shown on Figure 1, but the fixed resistance 5 is replaced by a variable resistance 9. The latter permits of varying in certain limits the high frequency voltage transmitted by the generator 1 to the loading device 8 owing to the voltage drop RI caused by the current flowing through the said resistance. When a weak cou-

pling is desired, the resistance is adjusted to the maximum of its value. On the contrary, when a strong coupling is desired, the resistance is adjusted to the minimum of its value. The coupling can take all the intermediary values which are permitted by the variation of the resistance 9 from its minimum to its maximum.

In Figures 1 and 2 the resistances 5 and 9 have been shown at the entrance of the co-axial feeder, but they can be located at any point of the feeder.

The transmitter plant shown on Figure 3 comprises two transmitter stations 10 and 11 connected with a common feeder through the medium of resistances 13 and 14, the resistance 13 connecting the transmitter 10 with the feeder 12 while the resistance 14 connects the transmitter 11 with the feeder 12.

The operation of the device is as follows:

The current issuing from the transmitters 10 and 11 flows through each of the resistances 13 and 14; if, for any reason, for instance owing to an accidental variation of the grid excitation, one of the transmitters transmits a larger output, a stronger current flows through the corresponding resistance which dissipates more energy, thus tending to bring to its normal value the energy received by the loading device.

The invention has an absolutely general scope, and can be applied to all kinds of loading devices; it is more particularly advantageous for transmitters with a wide traffic range or for transmitting devices which use large passing bands such as the transmission of images in television.

PIERRE PAUL GAMET.

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BY A. P. C.

P. P. GAMET
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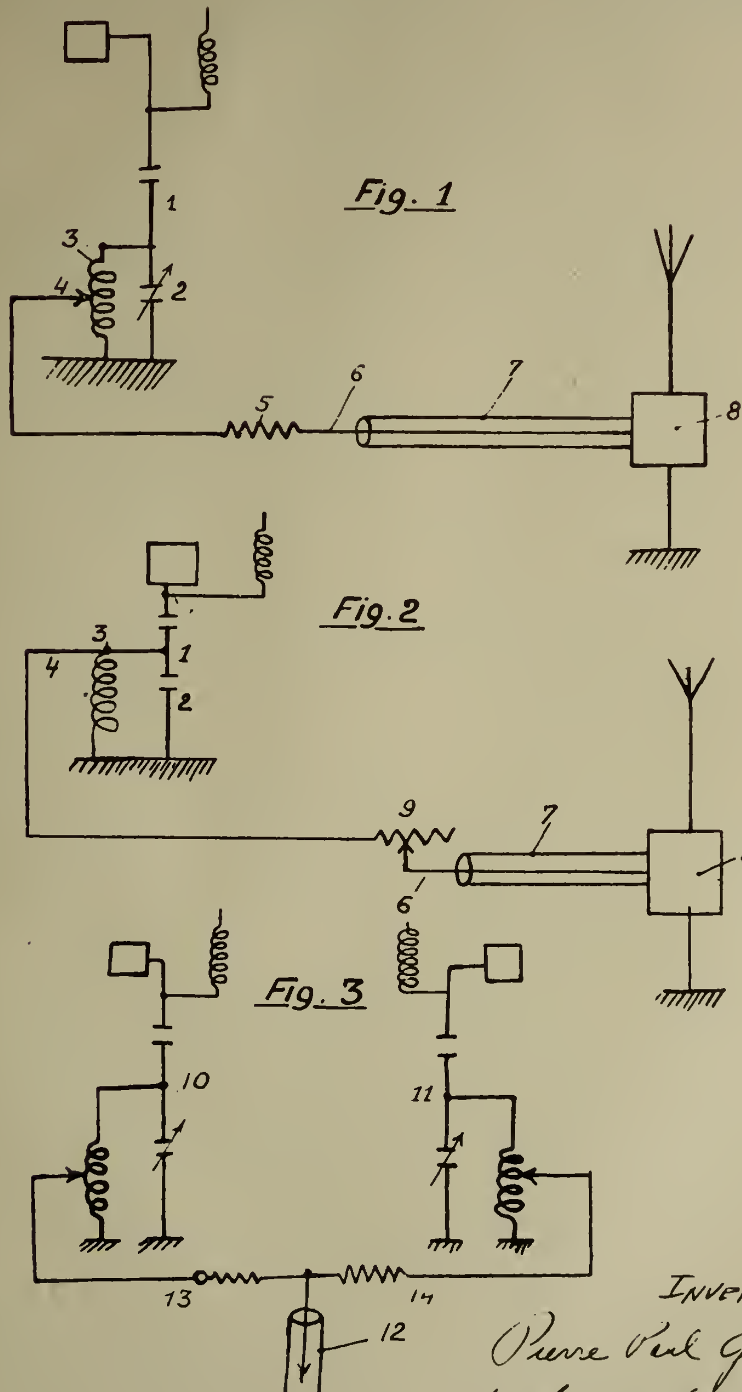

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Published May 25, 1943

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ALIEN PROPERTY CUSTODIAN

AERIAL SYSTEMS FOR RADIO BEACONS

Pierre Paul Gamet, Paris, France; vested in the Alien Property Custodian

Application filed May 9, 1942

This invention relates to improvements in aerial systems for radio beacons.

It relates more particularly to an aerial system for radio beacons which permits to carry into effect a well known method of radio direction finding.

In the known aerial systems for radio beacons it is necessary that the distance between the three aerials insuring the transmission of the radioelectric waves in a preferential direction is equal to a quarter of the wave length, which offers the disadvantage to require a cumbersome device which can be mounted only with difficulty on a rotating plate for the obtention of a rotating beam.

Furthermore, these systems require the use of at least three aerials.

The present invention has for its object to remedy to these disadvantages and to provide a device with two aerials which are set very close together, the said device permitting to obtain a radiation in a preferential direction and in a given range of frequencies.

On the other hand, the known aerial systems for radio beacons necessitate a fourth aerial for the obtention of a circular radiating beam, which still increases the space required by the system and the cost of the latter.

Another object of the present invention is also to do away with this disadvantage by providing an aerial system for radio beacons which necessitates no special aerial for the circular radiating beam.

An improved aerial system for radio beacon permitting to attain the above mentioned objects possesses the characteristic features which result from the following description and especially from the appended claims.

Systems made according to the invention are shown diagrammatically in the appended drawing, in which:

Figures 1 and 2 are radiation diagrams of the system;

Figures 3 and 4 are diagrams of the system, and

Figure 5 is a view of a system for the obtention of a rotating radiation.

The diagram of Figure 3 comprises an aerial **1** which is supplied directly by the transmitting station **3** by means of a feeder **4**.

An aerial **2** is supplied by the same transmitting station **3** by means of the feeder **4** and of a phase shifting box **5** so that the feeding voltage of this aerial is shifted in phase by a certain value with respect to that of the other aerial.

The operation of the device is identical to that of the device which is generally used for the obtention of the radiation diagram working in a preferential direction and in which a system of two aerials is used which are spaced from another by a quarter of a wave length, this spacing effecting the difference of course giving the phase shifting which is necessary for the operation of the system and permitting to obtain the radiation diagrams of Figures 1 and 2.

This phase shifting obtained by a difference of course is effected, in the device according to the invention, through a phase shifting circuit which permits by adjusting the phase in a convenient manner to set the aerials at any distance from another. Thus a radiation diagram with a radiation in a plane shown by the cardioid **6** is obtained, the axis of the aerials being at **7**.

This device permits to easily carry out all the combinations which are necessary for the operation of apparatuses such as rotating radio beacons or beaconing devices for a channel, namely:

(1°) Reversing of the direction of radiation;

(2°) Obtention of a rotating radiation beam;

(3°) Obtention of a circular radiation.

The direction of the radiation is obtained by reversing the feeding of the aerials **1** and **2**.

The aerial **1** is then supplied through the medium of the phase shifting circuit **5** and the aerial **2** is supplied directly. For carrying out this operation one may provide a reversing switch **8** which effects the changes of connections which are necessary for directing the radiating beam sometimes in a direction and sometimes in the other, by reversing the supply or feeding of the aerials.

For obtaining a rotating directional radiation beam the conveniently supplied aerials are mounted on a plate **10** revolving about an axis **11**.

The rotation of this plate **10** effects the rotation of the directional radiating beam.

This system offers the advantage that it can be mounted on a plate of small dimensions since the aerials can be very close to another contrary to the known systems where the distance between both aerials must be equal to a quarter of a wave length.

A circular radiating beam is obtained by feeding the aerials **1** and **2** in phase.

Since these aerials **1** and **2** are set at a small distance from another, they form a unit which is equivalent to a single aerial and thus radiate equally in all the directions.

With respect to the known systems this device offers the advantage that it requires no special aerial for obtaining the circular radiation.

PIERRE PAUL GAMET.

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BY A. P. C.

P. P. GAMET

AERIAL SYSTEMS FOR RADIO BEACONS

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Fig. 1

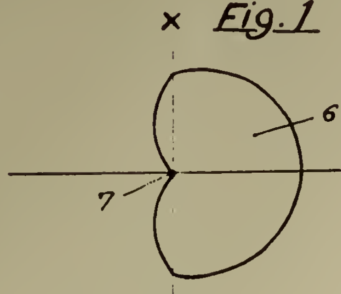


Fig. 2

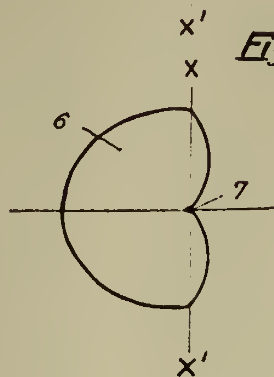


Fig. 3

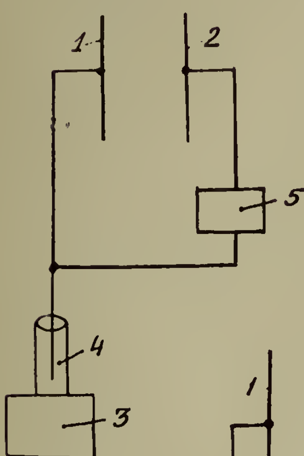


Fig. 4

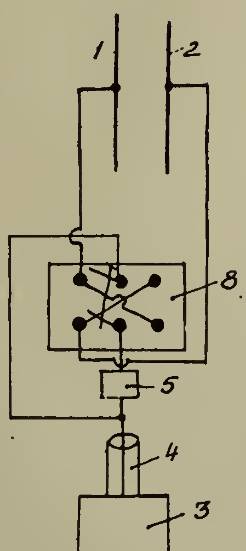
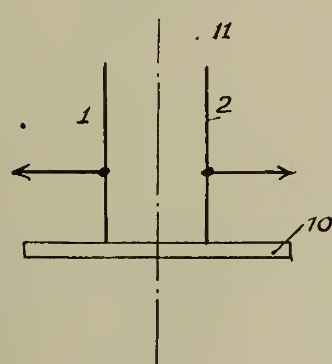


Fig. 5



INVENTOR

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Published May 25, 1943

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ALIEN PROPERTY CUSTODIAN

PRODUCTION OF COMPRESSED AIR ON BOARD AIRCRAFT

Charles Raymond Waseige, Rueil, France; vested in the Alien Property Custodian

Application filed May 21, 1942

My invention relates to plants for the production of compressed air on board aircraft.

As is well known, it is necessary to provide on board aircraft of the modern types sources of air compressed at widely different pressures the outputs of which, whether continuous or non-continuous, may be either small or very large according to utilisations. Therefore the plants for the production of compressed air must be correspondingly arranged, as a result of which great difficulties are encountered owing to the reduction of atmospheric pressure and air density at great heights.

It has been previously proposed to fill an air tank or reservoir to the required maximum pressure and to combine the same with pressure relief devices capable of supplying air at the several required pressures. One air supplier or generator would be necessary in such case. However, such an air generator which ought to be such as to ensure considerable air deliveries as for example the low pressure air delivery as used for de-icing the leading edges of aircraft wings and at the same time high air pressures which may reach fifty kilograms per square centimeter would be heavy, cumbersome and hard to cool while absorbing an unduly high power.

The present invention has for its principal object to provide for use on board aircraft an improved plant or installation for the production of compressed air, the said plant being such as to fulfill the requirements while being free from the aforesaid disadvantages.

A further object of my invention is to provide such a plant or installation comprising at least two air generators, one of which draws the atmospheric air and feeds the second generator, a valve being arranged in the air circuit of the first generator so as to determine the pressure at which the second generator is fed in terms of the flying height or altitude, the said pressure being preferably maintained substantially constant in absolute value.

Owing to the superfeed or supercharge of the second generator as thus provided, the plant can supply air at the required pressure regardless of the altitude of flight or the aircraft for feeding the several servo-contrivances.

Advantageously the said valve is arranged on the pressure side circuit of the first generator which then feeds both the second generator and that part of the plant to which its delivery pressure is suited.

The valve may also be arranged in the suction circuit of the first generator so as to more or less throttle the air inflow which feeds the same.

The adjustment of the valve is preferably controlled by some form of manometric capsule or cartridge of any approved type.

In a preferred constructional form, the plant further comprises a third generator adapted to deliver air at a pressure higher than that of the second generator delivery, the pressure side circuit of which feeds both the said third generator and that part of the plant to which its delivery pressure is suited. The three generators will be respectively termed "low pressure", "medium pressure" and "high pressure".

Such generators may be of any suitable approved type. The low pressure generator may advantageously comprise either a pump of the volumetric type or the supercharging compressor for the engine, the latter being necessarily arranged to that effect before the carburettor, as known per se.

The several air generators are preferably aligned and so arranged as to build a self-contained assembly actuated by a single shaft.

Moreover, it is known that heretofore the suction of the low pressure pump has been used for revolving the gyroscopes of the instruments mounted on board the aircraft, the necessary depression to that effect representing about two hundred grams. When it is now borne in mind that at an altitude of ten thousand meters, the atmospheric pressure amounts up to two hundred and sixty grams only, it will be understood that even when using a pump capable of producing an almost absolute vacuum, it is impossible to ensure over a certain altitude proper operation of the said instruments.

According to an advantageous feature of the invention and with a view to obviating the aforesaid disadvantage, the gyroscopes associated with the instruments mounted on board the aircraft are fed by the delivery side of the low pressure generator, eventually through a pressure relief device.

My present invention has also for its object certain accessory contrivances adapted particularly to the novel plant and notably an automatic cock or valve, certain of these accessory contrivances such as the pressure relief devices, pressure-limiting valves and the like being combinable with a manometric capsule or cartridge which may be either empty or filled with air at ground atmospheric pressure, so that the adjustment may be varied when the aircraft flies at varying altitudes.

Other objects and features of the invention will

moreover appear from the continuation of this description and with reference to the accompanying drawings which exemplify the invention and in which:

Figure 1 is a diagrammatic illustration of a plant or installation according to the invention;

Figure 2 is a partial view of a modification of this plant;

Figures 3 to 6 represent on a larger scale several members comprised in the plant shown in Fig. 1, namely in Fig. 3 a regulating valve, in Fig. 4 a regulator, in Fig. 5 an automatic cock or valve, and in Fig. 6 a pressure relief device;

Figure 7 represents a constructional modification of the valve adapted to limit the "low pressure" delivery pressure.

In the constructional form represented in Fig. 1, the plant or installation comprises three air generators, namely a low pressure generator **1**, a medium pressure generator **2**, and a high pressure generator **3**.

The low pressure generator **1** freely sucks the atmospheric air and has its delivery pipe **4** connected to a purifier or scrubber **5** of any approved type capable of removing from the air the oil or water particles carried by it.

The purifier or scrubber **5** is provided at its lower end with a pressure-regulating valve **6** urged by a spring **7** against its seat. This valve establishes communication between the inner chamber of the purifier and the atmosphere through an aperture **8** when the pressure in the said chamber exceeds a predetermined pressure corresponding to the tension of the spring **7**.

The compressed air leaves the purifier **5** through a pipe **10** which bifurcates into a pair of branch pipes **11**, **12**, one of which designated by **11** feeds servo-contrivances or like devices, while the other branch pipe **12** constitutes the feed pipe for the medium pressure generator **2**. It has been assumed in this example that there are two of such servo-contrivances fed by low pressure, namely the piping **15** of the de-icing device and the gyroscopes associated with the steering instruments, **16**. The piping of the de-icing device are fed through a cock **18** comprising a chamber inclosing a closing shutter **19** rockably mounted on a pivot and controlled by some rigging (not shown) so as to either close or open the air flow without causing any braking effect. An electric distributor **20** fed through a rheostat **21** directs through the pipes **15** the air which must reach the several pneumatic chambers arranged on the leading edges of the aircraft wings, the pulsation of the said chambers performing the de-icing action. The air is supplied to the gyroscopes associated with the steering gear **16** through a pressure-regulating valve **22** a constructional form of which will be described hereafter with reference to Fig. 3.

The medium pressure generator **2** which is fed by the low pressure generator through the pipe **12** is constituted by a compressor of usual type and forces through a pipe **25** (drawn in dot and dash lines) and preferably through a regulator **26** the compressed air into a reservoir **28**. The regulator **26** of which a constructional form will be described hereafter with reference to Fig. 4 provides a communication with the open atmosphere of the delivery pipe **25** as soon as the pressure in the reservoir **28** exceeds a predetermined limit. The air escapes from the reservoir **28** through a pair of outlet pipes **30**, **31**. The pipe **30** feeds the servo-contrivances which must be fed at medium pressure as for example the brakes, the automatic weapons, etc. while the pipe **31** supplies the excess air to the inlet of the high pressure air generator **3**.

The generator **3**, thus fed, forces the compressed air through a pipe **34** (drawn in thick solid lines) and preferably through a regulator **35** into a reservoir **36**. The regulator **35** is of a type similar to the regulator **26** and establishes a communication between the delivery side of the generator **3** and the free atmosphere when the pressure in the reservoir **36** exceeds a predetermined limit. Moreover, the pipe **34** is advantageously connected through a pipe **38** to a distributor **39** inserted in the pipe **31**. The distributor **39** of which a constructional form will be described hereafter with reference to Fig. 5 is so arranged as to shut off the upside part of the pipe **31** and to set up a communication between the atmosphere and the inlet side of the generator **3** when the outlet side of the latter is brought into communication with free atmosphere by the action of the regulator **35**. The circuit resumes normal condition as soon as the pressure is reinstated in the delivery pipe **34**. An undue output of the generator **2** is thus avoided when the generator **3** is inoperative.

The air compressed under a high pressure leaves the reservoir **36** through a pipe **38** which feeds those servo-contrivances which require high pressure actuation.

In Figure 1 is also shown a means of using the reserve of air compressed under a high pressure contained in the reservoir **36** for feeding those servo-contrivances which are actuated at medium pressure. To that effect, a branch pipe **40** connected to the pipe **38** leads through a cut off valve **41** inserted in the pipe **31** intermediate the distributor **39** and reservoir **28** to a pressure reducer or reliever **42**. The cut off valve **41** is manually controlled; its two alternative positions correspond respectively to the interruption of the air flow through the pipes **31** and **40**. The pressure reducer **42** of which a constructional form will be described hereafter by way of example with reference to Fig. 6 supplies medium pressure compressed air to a pipe **43** in which is inserted a non-return valve **44** of known type adapted to permit the air to flow in one direction only. The pipe **43** is branched off the pipe **31** intermediate the cut off valve **41** and reservoir **28** which can be therefore fed by medium pressure compressed air from the high pressure compressed air reserve contained in the reservoir **36**. Any undue bypassing of the circulating flow of air is prevented by the cut off valve **41**.

By way of completion of the description of this constructional form, the construction of certain of its constitutive parts will now be described.

The low pressure generator **1** which might be constituted by the compressor used for feeding the aircraft engine and branched off upside the carburetor is here shown as comprising a vacuum pump of the volumetric type essentially made up (as also illustrated in Fig. 2 which is a front view partly broken away of a generator belonging to the same type) of a body or casing and eccentered rotor **47** inclosed therein and fitted with vanes or blades.

The medium and high pressure generators **2** and **3** which may be of the centrifugal type are shown constituted by compressors including pistons and cylinders mounted on a common casing **48** to which the pump cylinder **1** is secured. The three generators **1**, **2**, **3** are aligned and driven

by a common actuating shaft 49 so as to form a self-contained assembly.

As illustrated in Fig. 3 which, as above stated, shows a constructional form of the regulating valve 22, the latter comprises a body made up of three parts, one of which (50) carries the air inlet union 51, while the second part (52) is screwed upon the former and comprises substantially a cylindrical tube fitted at its upper end with the air outlet union 53 and the third part (54) is screwed upon the part 52 and forms a cap fitted upon its top end.

The part 50 of the regulating valve 22 forms the housing of a disc valve 56 the seat 57 of which is situated above it and underneath the union 53. The valve 56 is carried by a sleeve 58 upwardly urged by a spring 59. A rod 60 connected to the sleeve 58 is urged by the spring 59 into contact with a projection on a sleeve 61 slidably fitted in the tube 52. The lower end of the sleeve 61 is provided with a gasket 63 tightly applied against the inner wall of the tube 52. A spring 64 accommodated in the sleeve 61 urges the same into a direction corresponding to the opening of the valve 56 and is abutted through the medium of a head member 66 on a membrane 67 carried by the flange-shaped third part 54 of the valve 22, holes 68 being formed in said part 54. The membrane 67 is of distortable character and forms one of the walls of a sealed chamber 69 in which vacuum prevails and which contains a spring 70 which urges the same downwardly (looking at the figure) that is to say in such a direction as to compress the spring 64. As will be understood, the pressure of the air that flows past the valve 56 exerts itself on the gasket 63, whereby when the said pressure imparts to the gasket a stress larger than the action of atmospheric pressure thereon and the tension of the spring 64, the sleeve is lifted and closes the valve 56. Re-opening of this valves takes place under the action of the spring 64 as soon as the air pressure prevailing inside the union 53 lowers again.

Furthermore, the membrane 67 is distorted by the spring 70 thereby enhancing the tension of the spring 64 when the atmospheric pressure diminishes, so that the effort exerted on the sleeve 61 and consequently the limit pressure of the air inside the union 53 are independent from the altitude or vary in terms of the altitude according to a determined law. The supply of the air that has flown through the regulating valve 22 to the servo-contrivances is thus ensured under the most suitable conditions.

In Fig. 4 is shown a constructional form of the regulator 26 or 35 of known type adapted to be traversed by the compressed air flowing between the unions 75 and 76 extending in the form of ducts 77 and 78 formed in the body 80 and leading to a chamber 81. A stop valve 82 is provided intermediate the union 75 and chamber 81. A duct 84 connected to the duct 77 upside the valve 82 leads to a union 85 freely communicating with the atmosphere. A needle valve 87 housed in the duct 84 is urged towards its seat by a spring 88. The needle valve 87 is connected to a rod 89 pivotally connected to a lever 90 one end of which is pivotally connected in turn to a stationary pin 91 while its opposite end is pivoted to a piston 92 subjected to the air pressure in the chamber 81 and urged in the opposite direction by a weighted spring 94.

A wedge-shaped cam 95 fixedly secured to the lever 90 co-operates with a block 97 which is applied against it by a spring 98.

It will be understood that normally the compressed air as forced by the generator flows through the regulator between the unions 75 and 76. Just as soon as the pressure of this compressed air exceeds a limit as defined by the tension of the spring 94, the piston 92 is shifted against the antagonism of this spring and rocks the lever 90. The latter lifts off the needle valve 87 and sets the union 75 into communication with the atmosphere, the chamber 81 being then shut off by the valve 82 from the atmosphere. By co-operating with the cam 95, the follower block 97 soon breaks the balance when the lever 90 is rocked.

Thereafter, when the pressure prevailing in the chamber 81 becomes normal again, the regulator operates in the reverse direction and re-establishes communication between the ducts 77 and 78.

In Fig. 5 is shown a constructional form of the distributor 39 whose body 100 respectively communicates sidewise through a union 101 with the upside portion of the pipe 31, through a union 102 with the downside portion of the said pipe 31 (the arrows showing the direction of flow of the air) and endwise through a union 103 with the pipe 38 (connected up to the delivery side of the high pressure generator) and through a union 104 with the atmosphere.

The body 100 is formed with a cylindrical portion 105 which extends between the union 103 and 101 and with a pair of annular seats 106, 107, respectively located on opposite sides of the inner mouth of the union or nipple 102. A valve 108 is slidably mounted in the cylindrical portion 105 and carries a gasket 109 having a convexity facing the union 103. This gasket is elastically applied by a washer 110 against the walls of the cylindrical portion 109.

The slide valve 108 is provided moreover with a disc valve 112 adapted to co-operate with the two seats 106 and 107 and urged towards the seat 106 by a weighted spring 114. When the high pressure compressor delivers air, the air pressure which acts on the gasket 109 counterbalances on the slide valve 108 the action of the spring 114, whereby the valve 112 is applied against the seat 107. The medium pressure air can then freely flow between the unions 101 and 102. However, when owing to the operation of the regulator 35, the compressor 3 forces the air into the atmosphere, the pressure which acts on the gasket 109 falls, whereupon the spring 114 shifts the slide valve 108 and brings the valve 112 into contact with the seat 106, thus shutting off the unions 101 and 102 from each other while establishing communication between the union 102 and consequently the high pressure compressor inlet and the atmosphere through the union 104.

In Fig. 6 is shown a constructional form of the pressure relief device or pressure reducer 42. Such device comprises a body or casing 120 communicating through a union 122 with the high pressure air inlet and through a union 123 with the outlet of the relief air. Both unions or nipples are interconnected by a port 125 forming the part of a shut off valve 126. A spring 127 urges the valve 126 towards its seat. The body 120 is provided opposite the valve 126 with a cylindrical extension 130 the end of which communicates with the atmosphere through a hole 131. A sleeve 132 fitted with a gasket 132′ seals the extension 130 and is urged by a spring 133 towards the valve 126 which carries a headed stem

134 opposite the said sleeve. It will be understood that with this arrangement the valve 126 is normally held closed and becomes open when a push is exerted by the sleeve 132 on the headed stem 134 when the air pressure prevailing in the union 123 sinks underneath a predetermined limit. The adjustment of the spring 133 may be varied by means of a manometric cartridge.

It is advantageous, generally speaking, to maintain constant regardless of the altitude of flight, the absolute delivery pressure of the low pressure compressor or alternatively to cause said pressure to vary concomitantly with altitude variations according to a determined law.

To that effect, in the constructional form shown in Fig. 7, the spring 7 associated with the valve 6 of the air purifier or scrubber may be combined with a tight manometric cartridge 140 containing air at the atmospheric pressure, for example at ground level pressure. The expansion of the cartridge 140 when the atmospheric pressure diminishes causes an increase of the tension on the spring 7 and compensates for the effect of the altitude on the valve 6. Alternatively vacuum might prevail inside the cartridge 140 which might then contain such a spring as would distort the same when the pressure diminishes, as shown in Fig. 2; the said spring being defined by reference numeral 142.

In the constructional example represented in Fig. 2, and applicable to a constructional form wherein the low pressure generator 1 serves the sole purpose of feeding the medium pressure compressor 2, the cartridge 140 controls a damper 144 movable in a casing connected to the suction pipe 1' of the generator 1. The cartridge 140 is inclosed in a tight casing 145 communicating with the delivery pipe 4 of the said generator. When the delivery pressure of the generator or pump 1 shows a tendency to increase in the casing 145, the cartridge 140 causes the inflow of air to the pump 1 to be throttled and vice versa. Owing to this arrangement, the pressure at which the air is forced or delivered is rendered invariable.

While I have described what I at present consider preferred embodiments of my invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the spirit and the scope thereof. Thus, in particular, additional pressure relief devices might be provided for feeding certain ancillary devices.

CHARLES RAYMOND WASEIGE.

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MAY 25, 1943.

BY A. P. C.

C. R. WASEIGE

PRODUCTION OF COMPRESSED AIR ON BOARD AIRCRAFT

Filed May 21, 1942

Serial No. 443,966

2 Sheets-Sheet 1

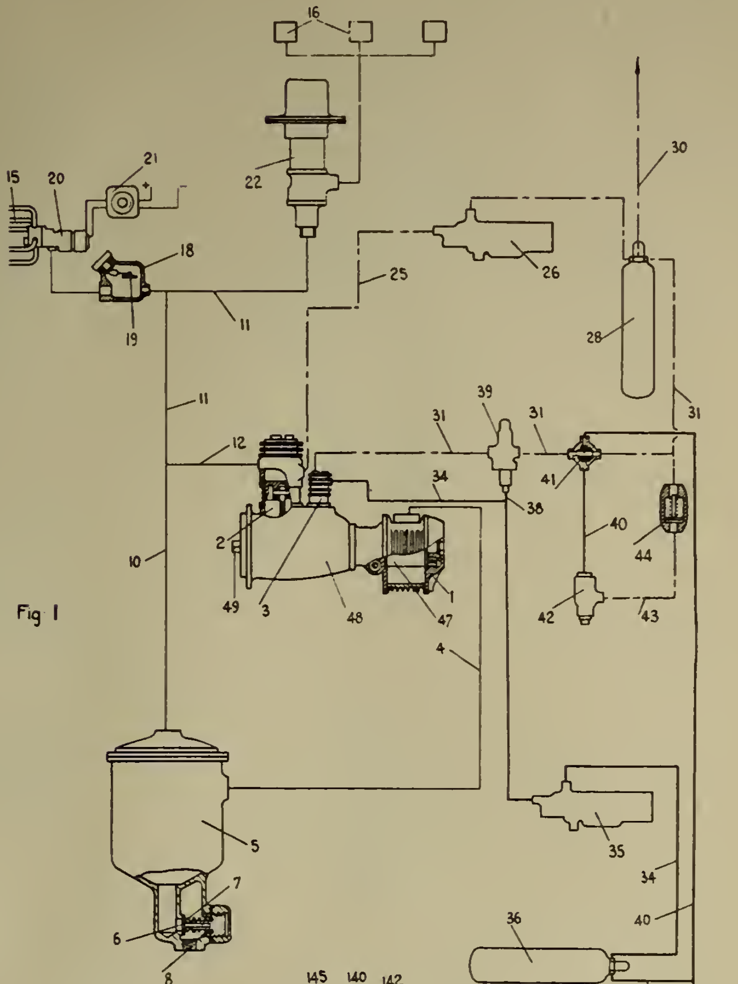

Fig 1

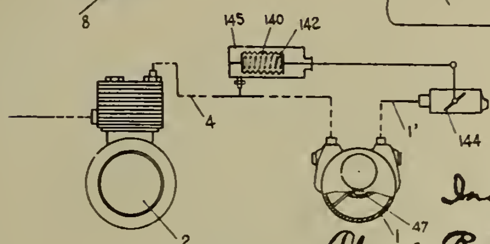

Fig: 2

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2 Sheets-Sheet 2

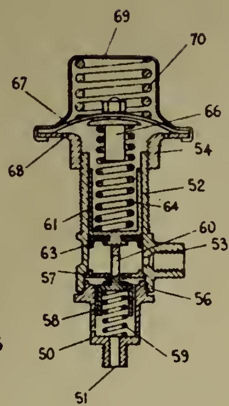

Fig: 3

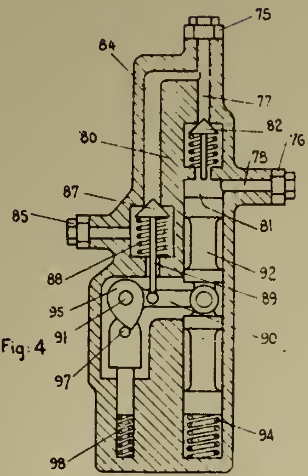

Fig: 4

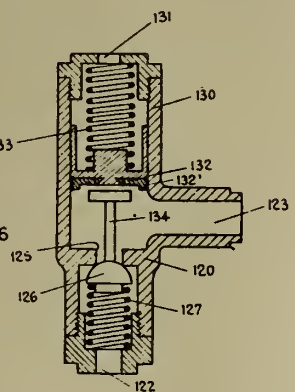

Fig: 6

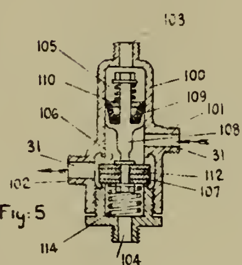

Fig: 5

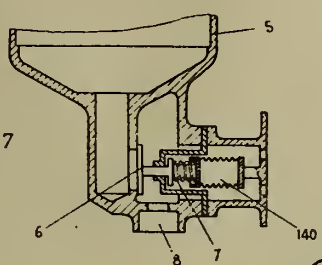

Fig. 7

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ALIEN PROPERTY CUSTODIAN

MULTI-ANODE ELECTRON TUBES AND WORKING CIRCUITS THEREFOR

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Application filed June 5, 1942

This invention relates to multi-anode electron tubes in connection with suitable working circuits.

The basic principle of this invention is to replace the usual anode of the usual electronic tubes (triodes, tetrodes, pentodes, etc.) by another more complex system of electrodes, which will be referred to hereinafter as "recovering anode" capable of recovering the kinetic energy developed by the impact of the electrons, which in usual tubes has no useful effect on the working circuit and is lost as heat, especially when the tube is working in class A or B.

The recovering anode consists of a series of electrodes, the direct current potentials of which range from a given maximum positive value down to a lower value, which may be positive, nil or even negative. Said electrodes are connected together by means of condensers so that the alternating current component of the anode potentials is strictly the same for all electrodes. Things are to be so arranged that superposing in the system the said ranging direct current potential and the alternating current component of the anode tension (which last is the same as for a usual anode) there is always an electrode having an instantaneous potential very slightly positive with respect to the cathode, at least when space current is flowing. While the most positive of all electrodes has always the task of causing space current to flow and with just the same intensity as in a usual tube, electron trajectories are to be so arranged that electrons always impinge on the electrode which in that moment is only slightly positive with respect to the cathode. Thus, while alternating current anode potential amplitude is limited by the direct current potential of the most positive electrode, which potential behaves as the direct current potential of a usual anode, anode dissipation is almost suppressed, because impact potential is reduced almost to zero.

Fig. 1 shows diagrammatically a multi-anode valve and electric circuit embodying the principle of the invention. **1** is the cathode; **2** the control grid; **3—3'** are a pair of electrodes so arranged as to produce an electron beam, according to the electron optics **4** are positive plates; **5** a plate maintained at zero direct current potential; **6** are plates maintained at negative d. c. potential; **7** are other plates arranged opposite the said negative ones, but not at level therewith and connected in parallel to said plates **6**; **8** is the tank condenser of the resonant anode circuit; **9** stands for the load; **10** is the inductance of the resonant circuit; **11** and **12** are the terminals for the input signal; **13** is one of the electron trajectories; **14** is the symmetry axis thereof; **15** and **16** are feed batteries and **17** is the tube bulb.

The electron beam emerging from **3—3'** and accelerated by the most positive ones of the electrode **4** (the most positive one may consist of a wire net portion fitted at right angles to the electron path so as to electrostatically act as a usual anode) follows a substantially parabolical path the form of which depends on the electron velocity, i. e. on the instantaneous value of the alternating current anode potential component. By properly adjusting the distance between the two electrode sets and the inclination of the equipotential planes connecting each electrode pair **6—7** it is possible to obtain that at any moment the instantaneous trajectory ends on the proper electrode of the set. It is sufficient to arrange things so that the time taken by the electron to be longitudinally stopped (to reach the top of the parabole) to be the same taken thereby to be transversally brought on to the set of capturing plates by the transversal component of the electric field set up between the two plate sets. The electron should be captured when near the top of its parabole. Secondary emission is avoided by the said transversal component present even on the surfaces of the capturing plates **4, 5, 6**.

In case of operation in class A the batteries **16** simply recover power, because they are charged by the electrons reaching plates **6**, passing through said batteries and returning to the cathode through load circuit **8, 9, 10**. In case of class B operation, the plates **6** become useless, because they have the right potential for catching electrons only when there is no space current. In case of operation in class C even plate **5** and some of the plates **4** together with the corresponding battery portions might be missing.

With other words, it may be said that the described tube works as a usual one, as far as the electrone reach the mesh connected with the most positive electrode. In a usual tube they would be simply captured; in the new tube they emerge in a decelerating field where they are stopped, then caught; then they are conveyed again, through the remaining part of the battery, to the same path (load-cathode) as with a usual tube, but by avoiding to discharge that part of the battery which would give the anode, in correspondence of the instantaneous value of the alternating current potential across the loads a surplus potential, which is quite useless for the economy of the circuit and which, once spent, should be somehow lost again.

The finer is the disposition of the anode potential along the anode sets, the better is the effect obtained. But even with tubes having only two anode electrodes the reduction of dissipation may be considerable.

Fig. 2 shows by way of example a tube with two electrodes inserted in a circuit for high frequency amplification, particularly adapted for use for modulated high frequency class B amplification.

18 is the cathode, 19 the control grid, 20 the most positive of the two anode electrodes having a window 48 which may be closed by a wire net; 21 is an antisecondary grid, 22 a less positive anode electrode, 23 a condenser shunting the two anode electrodes as to high frequency; 24, 25 and 34 are high frequency chokes; 26 and 27 smoothing condensers; 28, 29 and 30 terminals for feeding direct-current tensions; 31 is a smoothing inductance; 32 a by-pass for the slightly positive bias battery 33 of the antisecondary grid 21; 35 is the usual bias battery for grid 19; 36 a coupling condenser for the input signal; 37 and 38 the terminals for the input signal; 39 the neutralizing condenser; 40, 41 tank condensers; 42 a blocking condenser; 43 the inductance for the resonant circuit, 44 the coupling for the load.

The electron beam, controlled by the grid 19, shaped so as to be slightly convergent, and accelerated by anode electrode 20, passes through window 45, then is decelerated and reaches anode electrode 22 if this one is positive; if not, it is reflected on anode electrode 20; it can be seen that in case of two electrodes anode the selection of the right electrode is obtained in simpler way.

In case of class B amplification of modulated high frequency, it is convenient to give electrode 22 half the direct current potential of electrode 20. Thus, when there is the carrier only, electrode 22 is always positive and is always the capturing electrode; this electrode, as an anode, works with full anode swing and has a practical efficiency of 66% instead of 33%, as would be; should the electrons reach directly either electrode 20 or also a usual anode. When modulation intervenes, electrode 22 becomes negative for a part of the cycle and then electrode 20 is the capturing one; modulation can be increased up to a swing utilizing the whole direct current tension of electrode 20. Thus the output is just the same as with a triode having the anode direct current potential of electrode 20, but when only the carrier is present, its efficiency is twice as much (the direct current anode current is delivered at half tension between the terminals 28, 30). When there is modulation, the efficiency is always higher than in a usual tube, because electrode 22 is always working at least for one half of the modulation cycle.

Antisecondary grid 21 may be given a slightly positive bias, because otherwise electrons might be unduly reflected even when electrode 22 is positive, due to the roughness of the equipotential surfaces near grid 21.

It is to be remarked that the potential of electrode 22 has no effect on the value of the total anode current, because electrode 22 is screened towards the cathode by grid 21 and anode 20.

In case of class A low frequency amplification, the most convenient direct current potential of electrode 22 may be very low, especially if no-signal periods are foreseen; in this condition, although the quiescent anode current is maintained at its value, it implies low power losses.

Fig. 3 shows a quasi-constructional arrangement of the electrodes of a tube having a two electrodes anode. The same reference numerals indicate like parts as in Fig. 2. 45 are fins of electrode 20. The field between grid 19 and electrode 20 is convergent, so as to make the electron flow into beams; fins 45 serve for dissipating purposes and for rendering the field external to electrode 20 divergent, in order to avoid that the electron beam, once reflected, enters again window 23, which fact would cause troubles in space charge and in the linearity of the characteristic curves.

Fig. 4 shows a penthode with two anode electrodes. The parts existing in the tube shown in Fig. 3 are referred to by the same numerals: 46 is the screen grid and 47 the ordinary antisecondary grid of the pentode, which in this case is that having convergent properties, obtained by proper shape of said grid.

In the circuits in which the direct current anode current is fed through the resonant circuit inductance, it is possible to do without any high frequency choke even if a multiple anode tube of the above described types is used. In such case it is sufficient that the various direct current tensions be brought to the various electrodes by leads contained in the main tubular lead of the inductance, from a zero high frequency point of said inductance up to an end of it. Known laws teach that the insulation among the various leads is loaded only by direct current potentials.

In the cases according to Figures 3 and 4, the outer electrode 22 may be part of the tube envelope so as to render it possible to cool same by means of a fluid like in ordinary cooled-anode tubes. The heat of the inner anode 20 is generally dissipated by radiation, unless cooling by means of separate devices is adopted.

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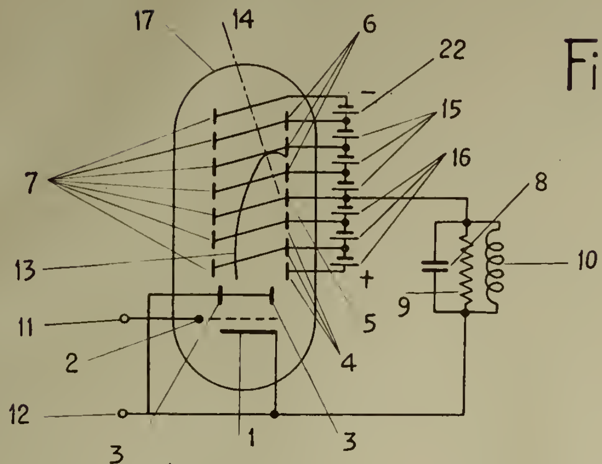

Fig. 1

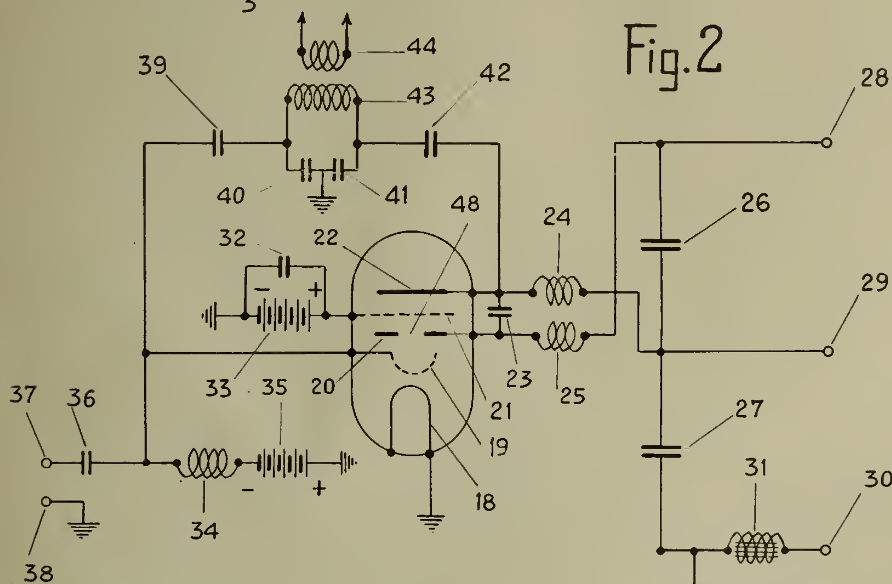

Fig. 2

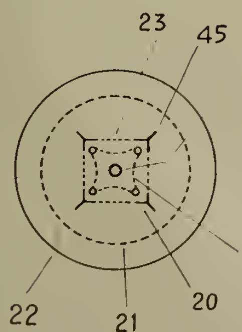

Fig. 3

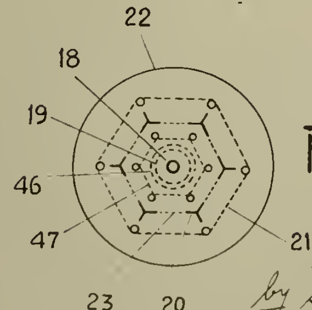

Fig. 4

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